Determinants of Financial Stress in Emerging Market Economies

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ABSTRACT

The global financial crisis of 2008–2009 illustrates how financial turmoil in advanced economies could trigger severe financial stress in emerging markets. Previous studies dealing with financial crises and contagion show the linkages through which financial stress are transmitted from advanced to emerging markets. This paper extends the existing literature on the use of financial stress index (FSI) in understanding the channels of financial transmission in emerging market economies. Using FSI of 25 emerging markets, our panel regression estimates show that not only advanced economies FSI, but also regional and nonregional emerging market FSIs significantly increase domestic financial stress. Our findings also suggest that there is a common regional factor significantly affecting domestic FSI in emerging Asia and emerging Europe. Furthermore, the results from a structural vector autoregression model with contemporaneous restrictions indicate that although a domestic financial shock still accounts for most of the variation in domestic FSI, regional shocks play an important role in emerging Asia.

I. INTRODUCTION

The recent global financial crisis demonstrates the adverse effects of financial globalization. Although financial integration brings direct and indirect benefits to economies (Stulz 2005, Kose et al. 2006, and Moshirian 2008), it may increase the countries' vulnerability to financial crises originating elsewhere. For instance, the freezing of the credit markets in advanced economies, particularly the United States (US), in late 2008 caused significant turmoil in emerging market financial systems. As emerging markets are rapidly integrated into global and regional markets, the origin of financial stress is also becoming ubiquitous and the impact felt borderless. For example, the financial crisis which started in Thailand in 1997 quickly spread to the rest of East Asia, and then to the Russia Federation and Brazil.

The transmission of financial crises has been the subject of a substantial body of economic literature. Cross-border transmission of financial crises is often manifested in co-movements of asset prices and capital flows during times of crisis. Earlier studies classified the causes of financial contagion into two broad categories (Calvo and Reinhart 1996; Dornbusch, Park, and Claessens 2000; Kaminisky and Reinhart 1999 and 2000; and Moser, 2003). First, financial asset prices and capital flows can move similarly when the economies share similar fundamentals and have strong macroeconomic interdependence through trade and financial linkages. Similar fundamentals may induce similar response to a shock, which lead to strong co-movements in asset prices and capital flows. Second, the co-movements may also result from herding behaviors and/or certain decisions of investors which affect different countries simultaneously. For example, a crisis in one country may prompt investors to withdraw from all emerging market countries.

While the impact of financial crisis is often devastating especially in emerging market economies, it has not been easy to monitor the buildup of a full-blown financial crisis and to trace its spread across borders. A growing number of economic studies have used a financial stress index (FSI) as a continuum and contemporaneous measure of the severity of financial crises. It argues that financial stress intensifies due to greater fragility in the financial systems and exogenous shocks. Since the pioneering work of Illing and Liu (2006)—who defined financial stress as episodes where economic agents are subjected to extreme uncertainty and varying expectations of loss in financial markets—other authors developed their own versions of FSI, including Hakkio and Keeton (2009) for the Federal Reserve Bank of Kansas City; Hollo, Kremer, and Lo Duca (2012) for European markets; Misina and Tkacz (2009) for selected advanced economies; and Yiu, Ho and Jin (2010) for Hong Kong Monetary Authority.

The use of FSI has far-reaching benefits for monetary authorities and financial regulatory and supervisory agencies. First, unlike existing measures of systemic financial risks, FSI can offer policymakers aggregate measure of financial stability without the complications of "micro-level" assumptions of other measures. Second, it helps assess how financial market turmoil affects the broader economy activity (Cardarelli, Elekdag, and Lal 2011 and van Roye, 2011).[1]

However, existing studies dealing with financial stress offer little insight on various channels for transmission of financial stress emanating from advanced economies and emerging market economies (either from the same region or from different emerging regions) to domestic financial markets. Balakrishnan et al. (2008 and 2011) explores the issue of financial transmission from advanced and other emerging economies to individual emerging market

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[1] See Arnold et al. (2012) for discussion on the challenges in monitoring banking systemic risks; and Allen, Bali, and Tang (2012) for discussion on the microlevel systemic risk measures.

economies, but paid little attention to geographical proximity in financial transmission and did not distinguish between regional and nonregional markets. Fernandez (2007) studied the impact of instability in the Middle East to regional and nonegional emerging stock markets, however he focused on political stability as the source of turmoil. This paper addresses the gap in the literature. Specifically, it aims to examine the determinants of financial stress in emerging market economies and to assess the transmission of financial shocks emanating from advanced and other regional and nonregional emerging market economies to individual emerging market economies. This paper adds to the previous literature in the following aspects.

First, it covers a longer period by extending the observations from 1992 to 2012 to include a number of episodes of emerging market crises in the early to mid-1990s as well as the latest crisis episode that affected the global financial markets in 2008–2009. Extending the sample period with more crises episodes will allow for the analysis to provide more reliable results regarding the transmission of a financial shock.

Second, this paper employs two methodologies for constructing domestic FSI for each emerging market in the sample—one is the variance-equal weights and the other is the principal component analysis. This will allow for robustness checks on the overall patterns of individual FSIs.

Third, this study assesses the impact of external financial shocks on domestic FSI by differentiating their economic and geographic origins, such as advanced versus emerging market economies as well as regional versus nonregional emerging market economies. The analysis specifically focuses on whether or not a shock originating from emerging market economies would exert influence on the FSI of an individual emerging market economy in addition to a shock from advanced economies. It will also assess the effect of a common regional factor in domestic FSI for emerging markets. The significance of a common regional factor would help explain the vulnerability of emerging market countries to regional financial contagion.

Fourth, following the panel regression analysis for the magnitude and significance of advanced and other regional and nonregional emerging market FSI on domestic FSI, we will employ impulse response functions and variance decompositions to assess the impact of a financial shock coming from advanced and other emerging market economies on individual emerging market economies' FSI. A financial shock generated from other emerging market economies are decomposed into regional and nonregional emerging market financial shocks. This will help assess whether or not the impact of a financial shock on domestic FSI would differ by the origins of the shock such as different economic (advanced versus emerging market economies) and geographic (regional versus nonregional) groupings.

To carry out the empirical analysis of this study, aggregate domestic FSI are constructed, drawing on the methodology used by Cardarelli, Elekdag, and Lall (2011) and Balakrishnan et al. (2011), for a sample of emerging market economies using variance-equal weights and principal component analysis as aggregation technique. To verify the importance of global, country-specific, other countries financial stress, and regional factors in explaining domestic FSI, a panel regression model involving 25 emerging markets from various regions including emerging Asia, emerging Americas, emerging Europe, and other emerging countries is employed using quarterly data from Q1 1992 to Q4 2012[2]. Specifically, it aims to determine

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[2] Emerging Asia includes the People's Republic of China; Hong Kong, China; India; Indonesia; the Republic of Korea; Malaysia; the Philippines; Singapore; Taipei,China; and Thailand. Emerging Americas includes Argentina,

which factors—including common regional factors—contribute to the increase of financial stress in developing economies. Knowing the significance of advanced and other emerging market FSI on domestic FSI, we examine the impact of a financial shock emanating from advanced and other emerging economies on individual domestic FSI using a structural vector regression approach with contemporaneous restrictions. This will allow us to determine the magnitude and persistence of the effects of advanced and other emerging market financial shocks on individual domestic FSI.

The paper is organized in the following sections. Section II discusses and constructs financial stress index. Section III presents the determinants of FSI and provides empirical specification for the panel regression which will determine the significance of advanced and other emerging market financial stress on domestic FSI, as well as the importance of a common-regional factor. Section IV provides the structural vector autoregression specification and presents the impulse response functions and variance decompositions of the impact of financial shocks coming from advanced and other emerging market economies on domestic FSI. Section V summarizes and provides policy suggestions.

II. FINANCIAL STRESS INDEX

A.   Literature Review

There is abundant literature investigating the occurrence and determinants of currency, banking, and sovereign debt crises in advanced and emerging economies; however, this literature failed to account for proper dating and intensity of said crises. For instance, Laeven and Valencia (2008) developed a database on the timing and frequency of banking, currency, and sovereign debt for both advanced and emerging markets. Eichengreen, Rose, and Wyplosz (2004) looked into currency crises by developing an index of foreign exchange market pressure which incorporates foreign exchange depreciation and changes in international reserves. Reinhart and Rogoff (2008) studied sovereign debt defaults and found that crises usually emanate from financial centers; and were often accompanied by other crises like currency and banking crises. However, these studies devote little attention to dealing with the contemporaneous severity of financial crises. This comes from the fact that most studies measure the occurrence of crises as a simple binary variable, i.e., no crisis takes the value of zero (0) and presence of crisis takes a value of one (1). As pointed out by Balakrishnan et al. (2011) and Illing and Liu (2006), the use of binary variable for crisis occurrence and dating does not provide a measure of intensity of crisis and near-miss events.[3] However, some studies used a sector-specific index to measure sector-specific intensity of crisis. For instance, Hanschel and Monnin (2005) derived a banking stress index for Switzerland, although stress from other financial sectors is not considered. Furthermore, most of these studies do not include crises that emanate from the equity markets.

Against this backdrop, several authors proposed an FSI to address the weaknesses of previous literature in dating and measuring the severity of financial crises. Several research works developed FSI by capturing key features of financial stress to identify a buildup in financial stress and measure the intensity of financial crisis. Illing and Liu (2006) created an index of financial stress for the Canadian financial system, employing a continuous variable with

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Brazil, Chile, Colombia, Mexico, and Peru. Emerging Europe includes Czech Republic, Hungary, Poland, Russian Federation, and Romania. Other emerging countries include Egypt, Israel, South Africa, and Turkey.

[3]   Some periods of heightened financial market stress do not evolve into full-blown financial crisis. For example, the emerging market equity sell-off in June 2006 had little macroeconomic impact, although it raised asset price volatility in some countries.

a spectrum of values where extreme values correspond to periods of financial crises. Their method was adapted and refined by Cardarelli, Elekdag, and Lall (2008 and 2011) which was used by the International Monetary Fund in their *World Economic Outlook 2008*; while Balakrishnan et al. (2009 and 2011) developed a similar index for 18 emerging economies and used at the subsequent issue of IMF's *World Economic Outlook 2009*.[4]

The use of FSI as a means of dating the duration and assessing the severity of financial crises has also gained popularity among monetary authorities and financial regulatory institutions. For example, the Federal Reserve Bank of Cleveland, Kansas, and St. Louis post their respective FSI in their website. Other researchers covering advanced and emerging economies employ the said index, albeit with different component financial variables to suit domestic financial characteristics. For example, unlike the use of foreign exchange market pressure index, Yiu, Ho, and Jin (2010) used at-the-market implied volatility of Hong Kong dollar per US dollar for the exchange rate component of the FSI. Van Roye (2011) used several indicators to measure financial stress in Germany's banking sector, including Treasury Bill and Eurodollar future contract (TED) spread, money market spread, and banking beta.

Another branch of literature on FSI examines the link between financial stress and economic activity. For example, Davig and Hakkio (2010) found the US economy fluctuates between episodes of low financial stress and high economic activity; and high financial stress and low economic activity. Other papers in this field deals with the contribution of financial stress index to improving forecasts on economic activity. Ng (2011) showed FSI improves forecasting performance at horizons of 2–4 quarters for the US economy; while van Roye (2011) had similar finding for Germany. Cardarelli, Elekdag, and Lall (2011) identified episodes of financial turmoil in advanced economies using FSI and assessed the impact of financial stress on the real economy. They found that financial turmoil characterized by banking distress is highly associated with severe and protracted downturns than stress originating from securities or currency markets. In addition, they also argued that economies with more arms-length financial systems appear to be particularly vulnerable to sharp contractions.

This paper follows the field of literature set by Balakrishnan et al. (2011) which employs FSI to examine cross-border transmission of financial stress. Balakrishnan et al. (2011) created FSI for emerging economies using the same methodology as Cardarelli, Elekdag, and Lall (2011). They argued that domestic financial stress index in an emerging economy is influenced by financial stress in advanced economies as well as common factors like global gross domestic product (GDP) growth and interest rates; and country-specific factors like degree of financial and trade linkages and other domestic macroeconomic vulnerabilities. Their findings suggest that financial crises in advanced economies pass-through strongly to emerging economies; and that the depth of financial linkages between the two determines the extent of pass-through.

While the previous literature focused on the impact of financial transmission from advanced to emerging markets, this paper argues that a shock emanating from emerging markets is also important as emerging markets gain increasing presence in the global financial system. This paper also examines evidence of regional financial contagion by focusing on the transmission of a regional shock. We look into the significance of a common regional factor as another key determinant of domestic financial stress index. If domestic FSI is significantly

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[4]   The main difference between the advanced and emerging economies FSI used by the IMF is the inclusion of indicators such as corporate bond spreads, inverted term spread, and TED spread for advanced economies, which is inapplicable to emerging economies given the low issuance of corporate bonds and data unavailability in emerging economies.

affected by a common regional factor, we may conclude that there is evidence of regional financial contagion. In this regard, the paper also assesses the effect of regional and non-regional financial shocks on domestic FSI.

B.   Constructing Emerging Market Financial Stress Index

An increasing number of research papers discuss financial stress and the definition of financial stress seems to differ among them. In this paper, we specifically follow the definition of financial stress for emerging markets as suggested by Balakrishnan et al. (2011). They define financial stress as episodes when the financial system is under strain and its ability to intermediate is impaired. It is usually associated with the following: 1) large shifts in asset prices; 2) abrupt increase in risk or uncertainty; 3) illiquidity of the financial system; and 4) concerns about the health of the banking system.

While we try to construct an index to capture the aforementioned conditions of financial stress, there are three key issues. First is to identify components of the index to cover key financial sectors. Second is to choose right variables to represent each component. And third is what weighting scheme to use to aggregate each component to a single FSI. Each is discussed accordingly, with an explanation on how we construct an FSI for each of the emerging markets in this paper.

1. Components and Variable Choices

We construct an FSI for each of the 25 emerging economies and 15 advanced economies following Balakrishnan et al. (2009 and 2011), Cardarelli, Elekdag, and Lall (2008 and 2011), and Yiu, Ho, and Jin (2010). As in the previous studies, the composite FSI for each economy covers the four major financial sectors of the economy, which include:

Banking Sector: The lack of suitable data and institutional differences across countries make it hard to have a clear definition of what constitutes a banking crisis. Some studies use ad hoc country-specific events to define banking crisis. Others rely more on a combination of qualitative and quantitative approach. For instance, Kunt and Detragiache (1996) define banking crisis as a situation where any of the following conditions holds: (i) non-performing loans is greater than 10%; (ii) the cost of bank rescue is at least 2% of GDP; (iii) banking problems result to large scale nationalization of banks; and (iv) extensive bank runs lead to emergency measures. Furthermore, some studies rely on quantitative methods using aggregate balance sheet data of banks.

In constructing FSI, we include a measure of banking stress called *banking sector* β as in Balakrishnan et al. (2011). This measure involves the ratio of bank share prices to total share prices. It provides a stationary measure of relative equity-return volatility and isolates banking sector-specific shocks. The banking sector β is given by:

$$\beta = \frac{\text{cov}(r,m)}{\text{var}(m)} \tag{1}$$

where, *r* and *m* are the returns to the banking sector stock price index and the overall stock price index, respectively. If β is larger than 1, then the banking sector is relatively risky as the volatility of returns on bank shares is greater than the volatility of returns for the overall market. The higher the banking sector β, the greater the banking sector's stress. It must be noted that

banking sector beta is not a measure of co-movement between the two variables. What it provides is a measure of how the banking sector returns are more volatile than the overall stock price returns.

Some studies, including Cardarelli, Elekdag, and Lall (2008 and 2011), van Roye (2011), and Yiu, Ho, and Jin (2010), use risk spreads such as TED spread and inverted term spread as a proxy for banking sector stress. However, including other banking sector variables may pose as a constraint for constructing FSI for each emerging market economies in the sample as most economies have relatively short time series data for said indicators. For this reason, this paper will only use banking sector β as a measure of banking stress in emerging markets.

Monthly average data on the banking sector price index and the benchmark stock price index were taken from DataStream. The data were converted to year-on-year returns by taking the difference between current period and last year's price index both in natural logarithm form. Twelve-month rolling covariance and variance of returns were used to compute for the banking sector β. To better capture banking sector stress, the derived series takes only positive values exceeding a threshold of one and zero otherwise.

Foreign Exchange Market: Currency crises are defined as periods of significant devaluations, losses in foreign exchange reserves, and/or defensive interest rate hikes. This study utilizes exchange market pressure index (EMPI) as proposed by Eichengreen, Rose, and Wyplosz (2004) and used in Balakrishnan et al. (2011). The EMPI captures the depreciation of the local currency with respect of US dollar and the reduction in foreign exchange reserves. It is defined as:

$$EMPI_{i,t} = \frac{(\Delta e_{i,t} - \mu_{i,\Delta e})}{\sigma_{i,\Delta e}} - \frac{(\Delta RES_{i,t} - \mu_{i,\Delta RES})}{\sigma_{i,\Delta RES}} \tag{2}$$

where, Δe and ΔRES denote month-on-month percent changes in the foreign exchange rate of local currency per US dollar and foreign exchange reserves; while σ and μ are standard deviation and mean, respectively. Monthly data for both foreign exchange and foreign reserves are taken from the *International Financial Statistics* of the International Monetary Fund. Other methods of measuring foreign exchange stress include hybrid volatility-loss approach such as the CMAX calculation as used by Illing and Liu (2006) and foreign exchange volatility following GARCH (1,1) as in Bollerslev et al. (1992). Eicheler et al. (2009) developed an indicator of currency crisis risk using price spreads between American Depositary Receipts (ADR) and their underlying. They found ADR investors perceive higher currency crisis risk when export commodity prices decline, sovereign yield spreads increase, trading partners' currencies depreciate, and interest rate spreads widen. This paper will utilize only the EMPI as a measure of foreign exchange market stress.

Equity Market: Most studies define equity crises as a sharp decline in the overall stock price index. The drop suggests greater expected loss, higher risk, or increased uncertainty about firms' future profits. The simplest measure of equity crisis is the use of a GARCH(1,1) process to take into account time-varying characteristics of movements in equity returns, following Bollerslev, Chou, and Kroner (1992). The volatility following a GARCH(1,1) process is given by:

$$\sigma_t^2 = \omega + \phi_1 \varepsilon_{t-1}^2 + \phi_2 \sigma_{t-1}^2 \tag{3}$$

Where σ² refers to the variance, and ε the error term in the regression given by:

$$y_t = \alpha_{i,t} + \beta\, y_{t-1} + \varepsilon_{i,t} \tag{4}$$

where y_t is the current period's equity return and y_{t-1} is the previous period's equity returns. Balakrishnan et al. (2009 and 2011), Cardarelli, Elekdag, and Lall (2008 and 2011), and Yiu, Ho, and Jin (2010) used the same approach in constructing equity market crisis index. This study will also use time-varying volatility of stock returns as a measure of equity market stress.[5] Monthly average data on benchmark stock price index were taken from DataStream. The data were converted to month-on-month returns by taking the difference between current and previous month's stock price index both in natural logarithm form.

Aside from the stock market volatility measure, we also include stock market returns as a component for equities market stress. The stock market returns are computed from monthly average data on benchmark stock price index availed from DataStream. The data were converted to month-on-month returns by taking the difference between current and previous month's stock price index both in natural logarithm form.

Debt Markets: Illing and Liu (2006) defines a debt crisis as the inability of sovereign nations or the private sector to service its foreign debts. Earlier literature on debt crises deals with a group of emerging economies that were exposed to severe external indebtedness in the early-1980s. However, the occurrence of emerging economies debt crises was identified mainly based on qualitative information. The most common indicator of debt crises has been the spread between risky and risk-free bond yields as a function of expected losses. Spreads will widen if expectations of future losses increase, or if greater uncertainty leads to lower confidence, implying a higher probable loss. Both factors are indicative of stress.

This paper uses sovereign debt spreads to measure sovereign debt stress. Data refers to yield differentials between long-term (10-year) local government bonds and US Treasuries in basis points. Monthly average data on sovereign debt spreads were taken from national sources accessed through CEIC Database. However, for some countries where data started in the late 1990s, government treasury yield spreads of comparable tenure was used. In cases where data is unavailable for certain months of the year, available data was extended to cover the whole year. Furthermore, for some countries with unavailable treasury yield data in the early 1990s, policy rates were used.

2. Weighting Scheme

The choice of a weighting scheme or how to combine the various components of financial stress into one index is perhaps the key to constructing an FSI. The difficulty arises from the lack of a reference series upon which meaningful weights can be derived and tested. Hence, various weighting techniques are considered.

The most common method is the use of *variance-equal weights*. With this approach, a financial stress index is generated by giving equal importance to each component variables. The variables are assumed to be normally distributed and the series is demeaned and

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[5]   The estimated variance equation for the equity returns following GARCH(1,1) shows that the estimated lagged squared residual and lagged variance are mostly significant for all countries in the sample. The estimated coefficients offer strong support on the persistence of volatility of stock returns as the lagged variance is significant and greater than the lagged squared residual.

standardized. The mean is subtracted from each variable before it is divided by its standard deviation, hence, the term "variance-equal" weights. Each component variable is computed as:

$$y_t = \frac{(x_t - \bar{x})}{\sigma} \tag{5}$$

where y_t is the demeaned and standardized series, $\bar{x}$ is the mean of the series, and σ is the standard deviation of the series. The demeaned and standardized components are then rebased from 0 to 100 (with 100 having the historically highest value) and averaged as done by Cardarelli et al. (2008 and 2011), and Yiu et al. (2010) or simply added (without rebasing) as in Balakrishnan et al. (2009 and 2011). The advantage of this approach is that it is easily implemented and applicable for cross-country comparisons. On the other hand, the disadvantage is that it assumes that the demeaned and standardized series follows a normal distribution.

Another popular approach is the use of principal component analysis. The main idea behind using the principal component analysis is to represent each component of the financial stress index into a single variable by forming linear combinations of each component. Through this approach, the resulting stress index captures the most common information from all components. The resulting index is derived from both the first and second principal component which refers to the coefficients of the linear combination that maximizes the variance of the resulting composite financial stress index.[6] Other weighting techniques used in the literature include credit aggregate-based weights, and transformations of the variables using their sample cumulative distribution functions. In this paper, the five components of the financial stress index, given by:

$$EMFSI = \beta + Stockreturns + Stockvolatility + Debtspreads + EMPI \tag{6}$$

are aggregated to a composite financial stress index using the *variance-equal weights* and *principal component analysis.* Following Balakrishnan et al. (2009 and 2011), all components are demeaned and standardized before adding for the variance-equal weights. For the principal component analysis, the first two components are added and used as the emerging market FSI. In case of series breaks, monthly FSIs were computed using the average of preceding and succeeding monthly values. Figure 1 presents the computed FSI for each country covered in this study using variance-equal weights sum and principal component analysis; including those for selected advanced economies.[7] The figures illustrate that both methods of aggregate FSI lead to comparable pattern of stressful and calm episodes. However, it can be noticed that the variance-equal weights method lead to more erratic or volatile pattern than the one using principal component analysis as aggregating technique.

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[6] The first two principal components are used to derive the individual country FSI as it captures around 50% of information available from each component.

[7] The FSI for advance economies are constructed following the same method as that for emerging market FSI to have comparable components and results. Advanced economies include Australia, Austria, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Figure 1: Individual Country Financial Stress Index
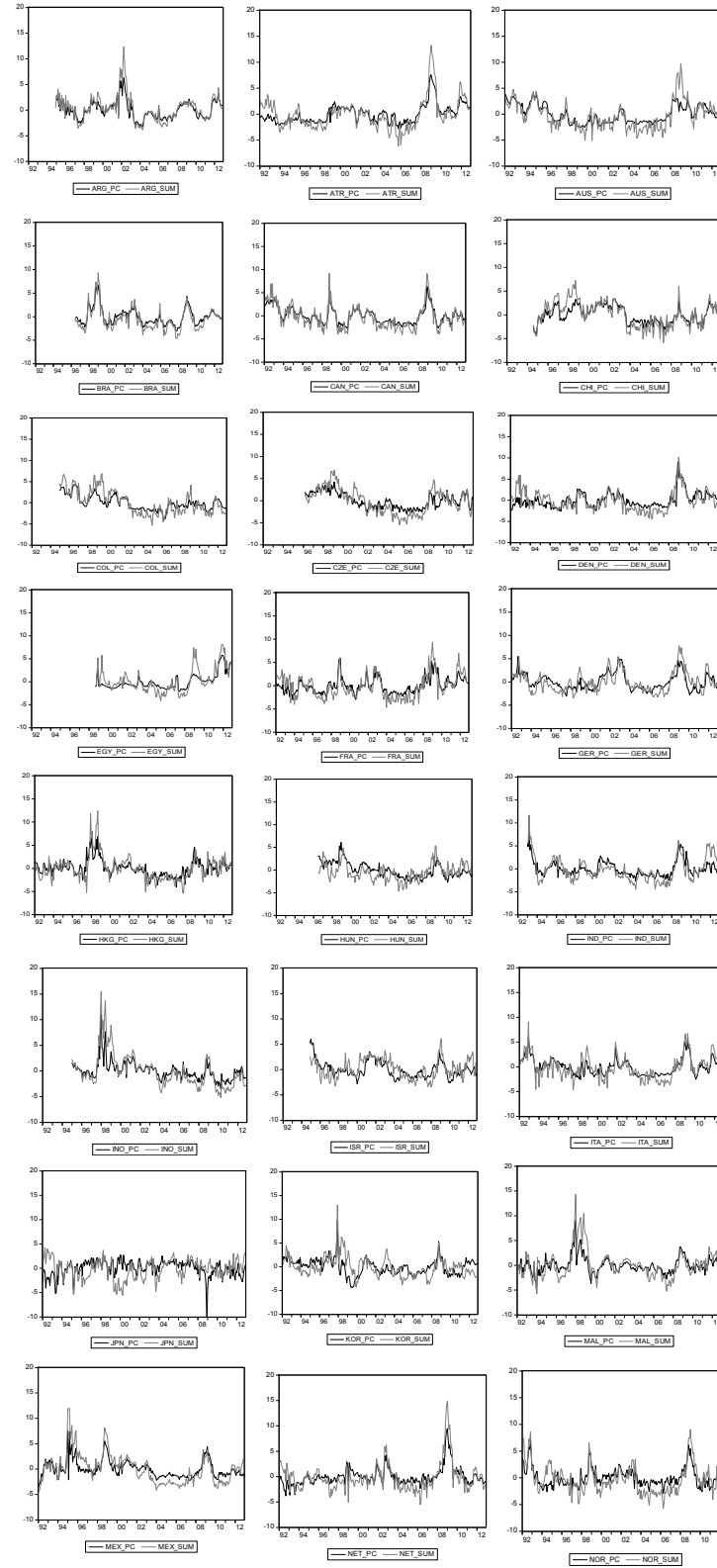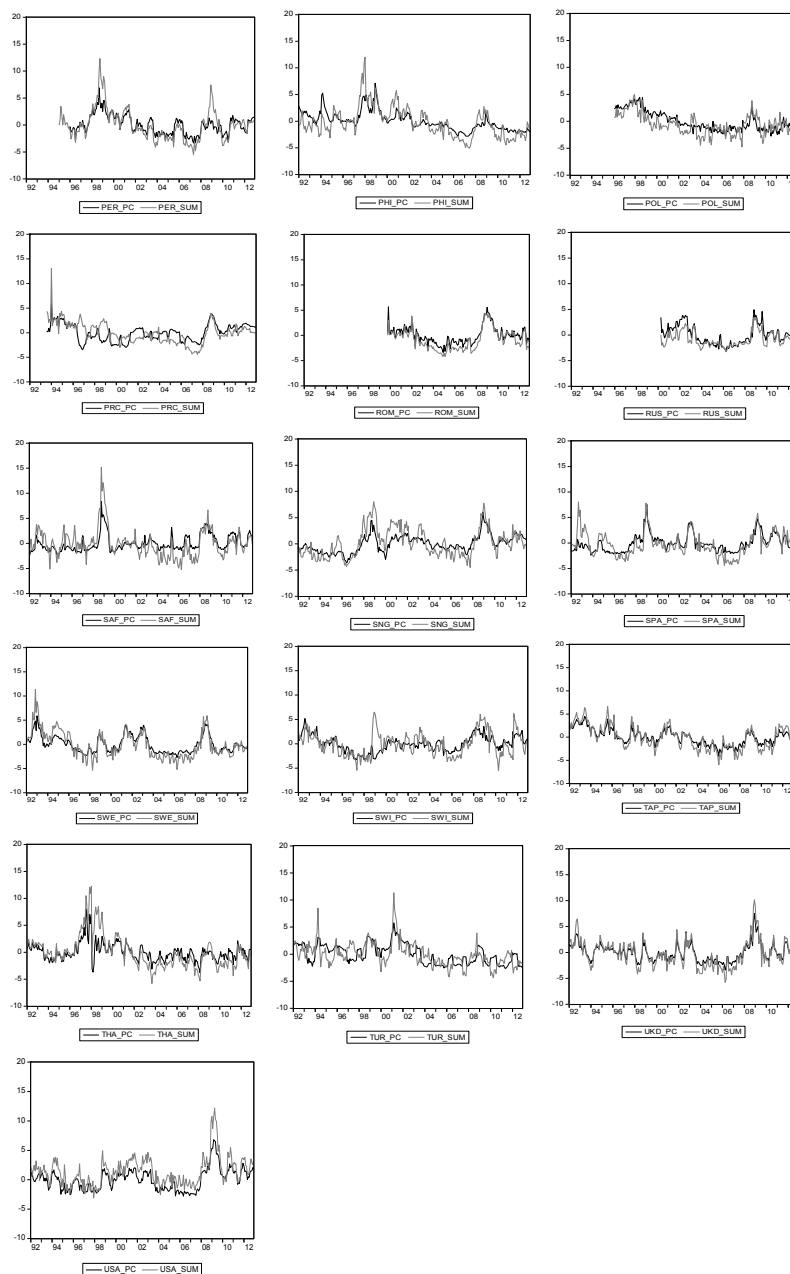
PC = principal components; SUM = variance-equal weights.

Note: The computed FSI corresponds to the aggregated values shown in equation (6). Monthly average data on banking sector price index and the benchmark stock price index were taken from DataStream. The data were converted to year-on-year returns by taking the difference between current period and last year's price index both in natural logarithm form. Monthly data for both foreign exchange and foreign reserves are taken from the *International Financial Statistics* of the International Monetary Fund. Sovereign debt data refers to yield differentials between long-term domestic government and US Treasury bonds in basis points. Monthly average data on sovereign debt spreads were taken from national sources accessed through CEIC Database. However, for some countries where data started in the late 1990s, government treasury yield spreads of comparable tenure was used. In cases where data is unavailable for certain months of the year, available data was extended to cover the whole year. For some countries with unavailable treasury yield data in the early 1990s, policy rates were used.

Source: Authors' estimate.

3.   Identifying Episodes of Financial Stress

Several approaches have been used in identifying episodes of financial stress based on the composite FSI. The simplest is through a graphical inspection of the composite index done by Yiu, Ho, and Jin (2010). Periods when the composite FSI peaks are considered highly stressful episodes, while troughs are relatively calm periods. Balakrishnan et al. (2009 and 2011) and Cardarelli, Elekdag, and Lall (2008 and 2011), used a more rigorous approach. They identified episodes of financial stress when the composite FSI index reaches 1.0 to 1.5 standard deviation above trend. Illing and Liu (2006) used an event study approach for Canada, where stressful events were drawn from annual and monetary policy reports of the Bank of Canada.

This study identifies periods of financial stress when the financial stress indices exceed its long-run trend by one point for the summed variance-equal weights and half point for the principal component analysis.[8] Given monthly structure of the dataset, stressful episodes also include periods (months) in-between identified stressful periods. For instance, February–April 1998 are also counted as stressful periods since they are in-between months of high stress levels (December 1997–January 1998; and June 1998–March 1999). Aggregate advanced and emerging markets, and regional FSIs refer to unweighted average of individual country FSI.[9] To identify aggregate emerging market financial stress periods, the difference between the unweighted regional FSI and its unweighted regional trend were used. The identified stressful periods are generally consistent with those of Balakrishnan et al. (2009) specifically for 1990s; and they capture the recent global financial crisis. However, several points are noted on the identified stressful periods. First, since the FSI is an *ex post* measure of financial instability, it would be inappropriate to use it in an *ex ante* context such that it would be used to assessment whether financial system is fragile or not today.[10] Second, the identified periods are based on unweighted average values and, hence, may not capture stressful periods experienced by one or relatively few countries in the sample. Third, the identified periods are presented to illustrate the performance of the constructed FSI. They are not used in estimation in this paper.

C.   Patterns of Advanced and Emerging Markets FSI

Based on the computed composite domestic FSI for both advanced and emerging economies, several observations are noted on the general patterns of financial stress. First, episodes of financial stress in emerging markets closely track those in advanced economies (Figures 2a and 2b). This pattern is clearly seen in the late 1998 and 2008–2009 financial crises, where the crisis in advanced countries instigated or aggravated emerging market financial stress. This observation is consistent with those from Balakrishnan et al. (2011). For the episodes in the early 1990s, financial stress has been more pronounced in advanced than emerging economies as northern Europe and Japan confronted banking sector woes. Nonetheless, emerging market FSI showed a brief spike. For the late 1998 episode, financial crises in Latin America and the Russia Federation compounded the financial strain in the US due to the collapse of Long Term Capital Management, causing both advanced and emerging market FSIs to increase. Finally,

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[8]   The trend was derived using the Hodrick-Prescott method where the smoothing parameter λ is set to 1,600. Since the first two principal component account for about half of variation, half point 0.5 was used as criteria to identify financial stress episodes. Using one point rule as in the variance-equal weights method might fail to capture significant episodes of emerging market financial stress.

[9]   Unweighted average is used so that individual country weight will not affect the aggregate financial stress index. For example, if the average FSI for emerging Asia is weighted, then the impact of the Asian financial crisis will be muted because of the huge weight of People's Republic of China.

[10]   See Borio and Drehmann (2009) on the discussion on the issues pertaining to measures of financial stability.

during the 2008–2009 global financial meltdown, advanced economies FSI reached a new high and was followed by emerging market FSIs.

Figure 2a: Advanced and Emerging Markets Financial Stress Index and Stress Episodes
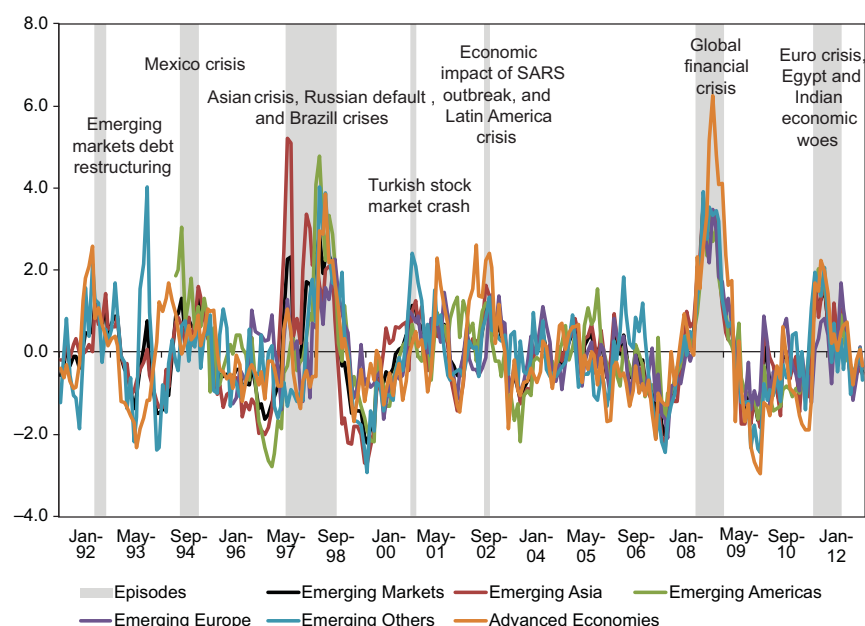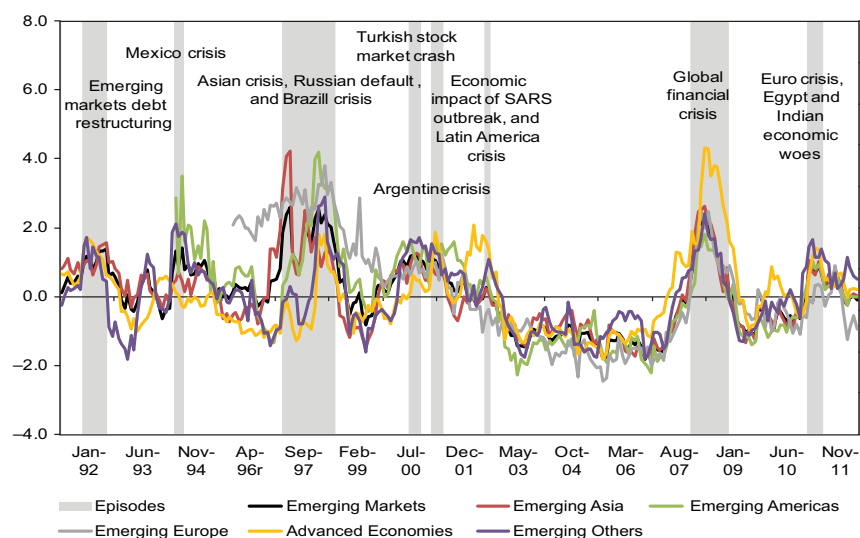(by region, using variance-equal weights of financial stress index components)

Figure 2b: Advanced and Emerging Markets Financial Stress Index and Stress Episodes
(by region, using principal component analysis)

Note: Aggregate and regional FSIs are unweighted averages. Aggregate emerging market financial stress periods are indentified based on the difference between the unweighted regional FSI and its unweighted regional trend, where the regional trend is computed as the average of individual emerging market trend using Hodrick-Prescott filter method.

Source: Authors' calculation.

Second, although FSI computed using variance-equal weights and principal components exhibit a similar pattern during both calm and stressful periods, there is a clear difference in their computed magnitudes. FSI derived using variance-equal weights tend to have greater/lesser magnitudes than those computed using principal components, implying that the variance-equal weights can better capture episodes of severe financial stress and "near-miss" events. This supports the dominant use of variance-equal weights over principal components in empirical literature due to its relatively lower detection failure rate.

Third, emerging market FSIs exhibit co-movement such that individual country financial stress index increases during periods of great financial market turmoil in emerging economies (Figures 3a and 3b). However, the peak of individual country FSIs can vary across countries during episodes of financial stress. For instance, only few emerging market countries experienced severe financial strain in 1995 and 2011–2012 compared to 1997–1998 and 2008–2009, where almost all emerging market FSIs rose. Furthermore, there are some episodes of individual market stress that are specific to a country and not to emerging markets in general. For example, the spike in Brazil's FSI in late 2005 backs emerging market trend.

Figure 3a: Emerging Markets Financial Stress Index and Stress Episodes
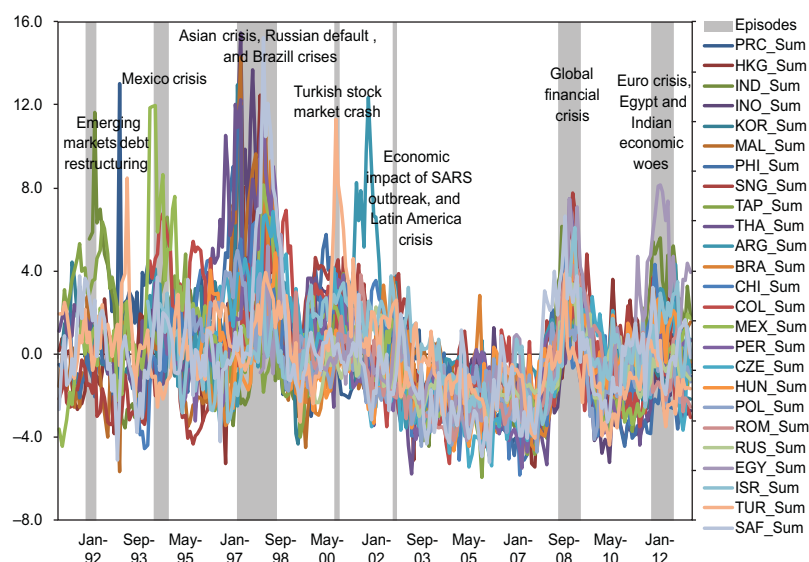(by country, using variance-equal weights sum of financial stress index components)
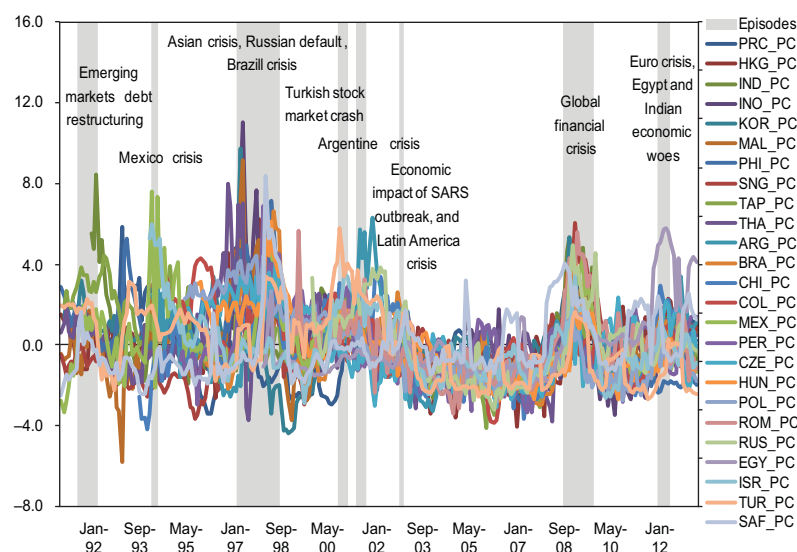
Figure 3b: Emerging Markets Financial Stress Index and Stress Episodes
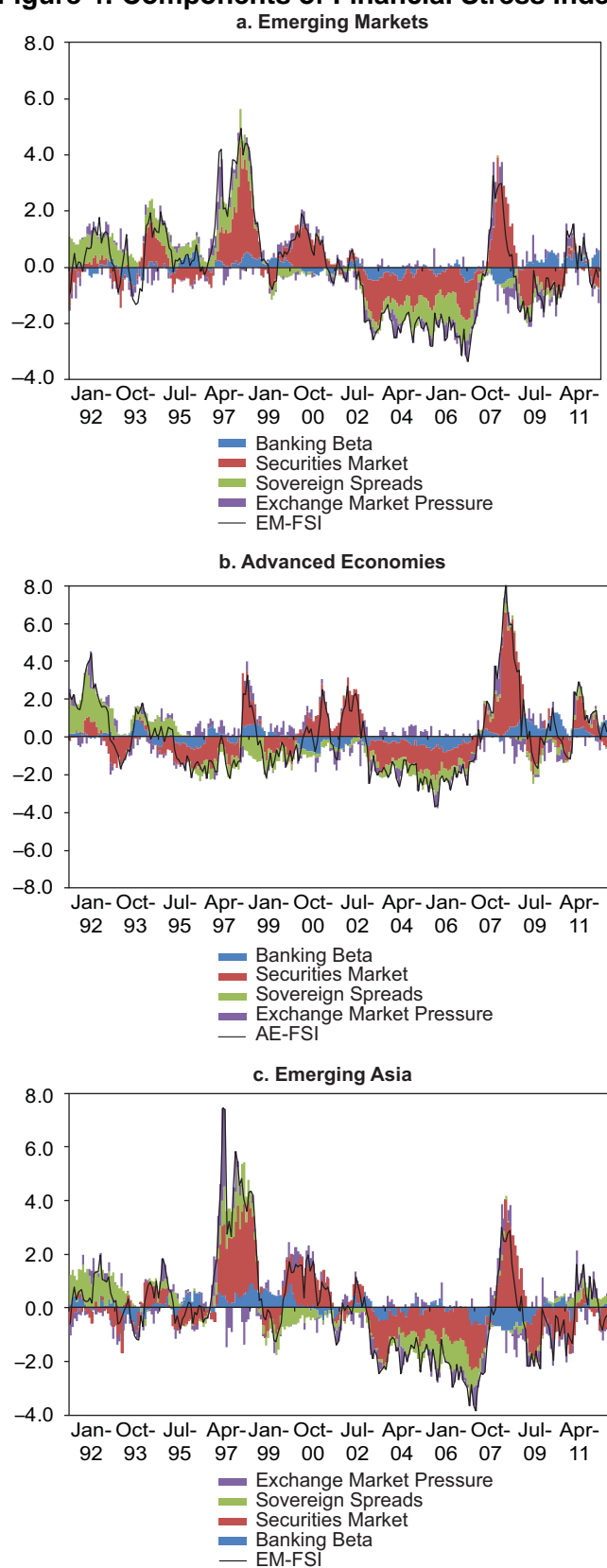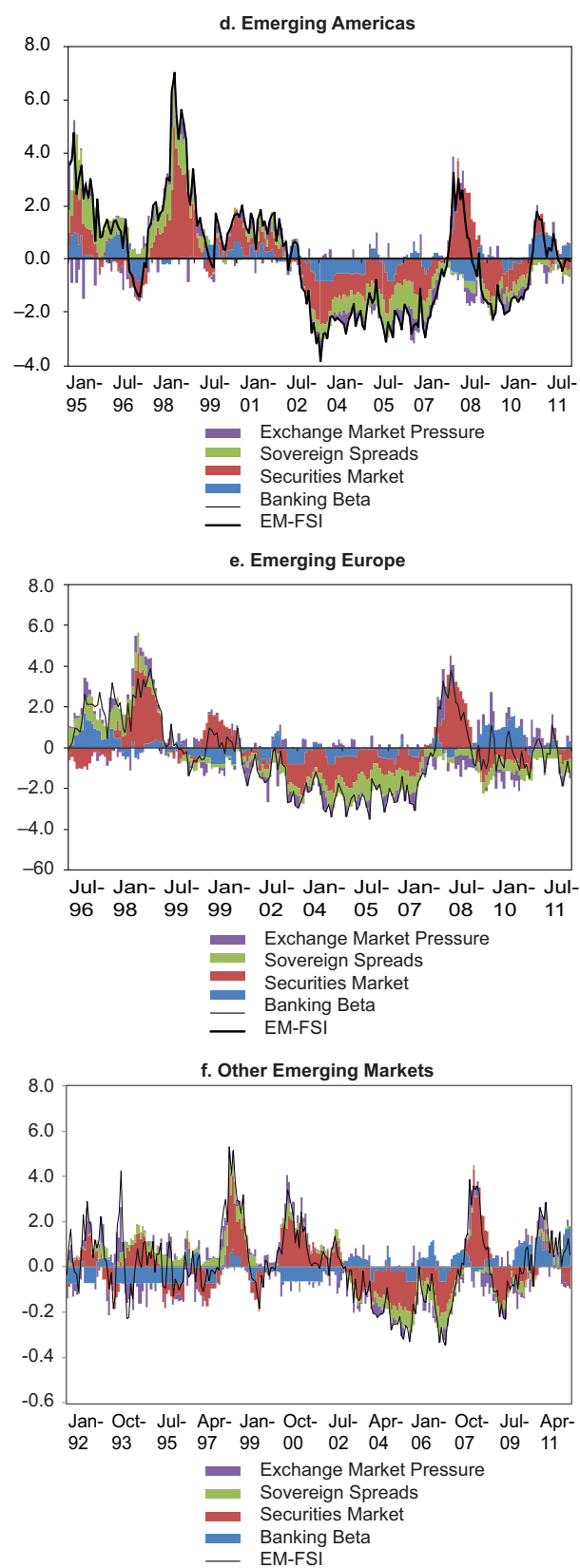(by country, using principal component analysis)

Note: PC = principal components; SUM = variance-equal weights.

Source: Authors' calculation.

Fourth, the constructed FSI indexes seem to capture moments of stress in emerging market financial systems very well. Figures 4a–4f present the component breakdown of the unweighted average of advanced and emerging economies FSIs, along with their regional groupings. For the emerging economies as a whole (Figure 4a), it can be observed that banking, equity, currency, and debt markets were all under severe strain during the 1997/98 crises; while equity and currency markets were under strain during the 2008/09 global financial crisis, reflecting emerging markets' healthy banking and fiscal positions. For the advanced economies (Figure 4b), debt markets played a huge role during the stress episode in the early 1990's, while almost all components were under stress during the 2008/09 crisis. Interestingly, banking sector stress has been elevated since the recent global financial crisis. Across emerging market regions (Figures 4c–4f), equity market stress dominates all financial crisis episodes. Nonetheless, there are differences in components per episode across regions. Currency market stress spiked in late 1997–1998 for emerging Asia; while debt market stress was more severe in emerging America during the same period. In general, the emerging market FSIs appear to capture moments of emerging market financial turmoil as well.

Figure 4: Components of Financial Stress Index

a. Emerging Markets

Banking Beta
Securities Market
Sovereign Spreads
Exchange Market Pressure
EM-FSI

b. Advanced Economies

Banking Beta
Securities Market
Sovereign Spreads
Exchange Market Pressure
AE-FSI

c. Emerging Asia

Exchange Market Pressure
Sovereign Spreads
Securities Market
Banking Beta
EM-FSI

d. Emerging Americas

Exchange Market Pressure
Sovereign Spreads
Securities Market
Banking Beta
EM-FSI

e. Emerging Europe

Exchange Market Pressure
Sovereign Spreads
Securities Market
Banking Beta
EM-FSI

f. Other Emerging Markets

Exchange Market Pressure
Sovereign Spreads
Securities Market
Banking Beta
EM-FSI

Note: Aggregate and regional component FSIs are unweighted averages.

Source: Authors' calculation

III. DETERMINANTS OF DOMESTIC EMERGING MARKET FSI

Understanding the determinants of domestic FSI is important for policymakers to ensure financial stability. Given the increasing degree of financial integration, it is also crucial to know whether there is financial contagion and, if so, to what extent a financial shock originating elsewhere affects domestic financial condition. In this section, we employ a panel regression analysis to assess the effects of financial stress from various sources such as global, country-specific, and other emerging market on domestic financial stress, as well as the role of global and domestic factors in explaining domestic FSI. We also include a dummy variable for region to evaluate the effect of region-specific factors.

A.   Data and Methodology

The dataset includes quarterly data for 25 emerging market economies. Data on individual emerging market FSI is taken from the previous section, while the advanced, emerging excluding country, emerging excluding region, and region excluding country FSI are unweighted average of individual FSI in Section II. Data for the global GDP growth and fiscal balance (% of GDP) are taken from the Oxford Economics. Data for London interbank offered rate (LIBOR), trade openness (exports plus imports as % of GDP), current account (% of GDP), and foreign exchange reserves are sourced from the *International Financial Statistics* and *World Economic Outlook Database* of the IMF and national sources accessed through CEIC. Data for financial openness is taken from the External Wealth of Nations Database and extended using the International Investment Position Database of the IMF. Monthly data are converted to quarterly series beginning Q1 1992–Q4 2012 using the average of 3 months of a quarter. In cases where quarterly data is unavailable, annual data is converted to quarterly series or the average annual value is used for fill the missing observations.

As mentioned in the previous section, FSIs computed using principal component analysis have smaller values than those computed using variance-equal weights. Specifically, the values for other emerging market FSIs using principal components are, on average, less than half than those for variance-equal weights. Among the global indicators, the change in global commodity price has the highest mean and standard deviation compared to global GDP growth and LIBOR. For openness indicators, de facto financial integration has greater cross-country variation compared to trade openness. For the domestic indicators, foreign exchange reserves has the highest standard deviation compared to current account and fiscal balance, implying that cross-country differences in emerging market foreign exchange reserve holdings is relatively high.

Panel unit root test of the Augmented Dickey Fuller (ADF) type was used to check for stationarity of all variables. The results reject the null hypothesis that all variables in the panel contain unit root, in favor of the alternative hypothesis of no unit root. However, for foreign exchange reserves, the null hypothesis cannot be rejected, therefore the lagged value of the first differenced foreign exchange reserves was used in the estimation. For the global indicators, a similar test was conducted using the same procedure and specification for time series data. The results show that the indicators do not contain unit root at 10% level of significance.

B. Panel Least Squares Regression

The model specification is as follows:

$$EMFSI_{i,t} = \alpha_i + \beta_1 AEFSI_t + \Sigma_j \beta_j EMFSIX_{i,t} + \Sigma_j \beta_j Global_t + \Sigma_j \beta_j Domestic_{i,t-1} + \Sigma_j \beta_j Dum_i + \varepsilon_{i,t} \quad (7)$$

where $EMFSI_{i,t}$ is the individual country FSI computed using variance-equal weights and principal component analysis; $AEFSI_t$ is the unweighted average of advanced economies financial stress index; $\Sigma_j \beta_j EMFSIX_{i,t}$ refers to measures of other emerging market financial stress index—EMFSI excluding country, EMFSI excluding region, and regional FSI excluding country, where each index is computed as residual using unweigthed average of other emerging market FSIs as dependent variables; and advanced economies FSI and global indicators as the regressors. $\Sigma_j \beta_j Global_t$ includes indicators such as global interest rates, global output growth, and global commodity price increase. $\Sigma_j \beta_j Domestic_{i,t-1}$ refers to lagged value of country-specific factors including financial and trade openness, current account balance, fiscal balance, and change (first difference) in foreign exchange reserves. $\Sigma_j \beta_j Dum_t$ refers to regional dummy variables for emerging Asia, emerging Americas, and emerging Europe, where the value takes one (1) if the country belongs to the region and zero (0) otherwise.

Equation (7) is first estimated without regional dummy variables ($\Sigma_j \beta_j Dum_t$) using fixed-effects ordinary least squares estimation. Based on the results of the Hausman test, country-specific effects are adequately modeled by fixed-effects regression. However, since we also want to test the significance of a common regional factor, equation (7) is estimated including three regional dummy variables using random-effects generalized least squares estimation. Using fixed-effects with regional dummy variables for equation (7) would be inappropriate since cross-country heterogeneity is already captured by the regional dummy variables.[11]

To avoid possible endogeneity, lagged values of country-specific factors were used in the estimation. Simple pairwise correlation of residuals reveals weak correlation between the estimated residuals and independent variables, implying that endogeneity is not a grave concern under the current specifications. To address possible heteroskedasticity, robust standard errors are used. To conduct robustness checks, Equation (7) is estimated for each region by dropping countries that are not member of the region. For example, equation (7) is estimated using fixed-effects only for emerging Asia countries and the same is conducted for the other regions.

C. Empirical Results

Balakrishnan et al. (2011) argued that emerging market financial stress is determined by several factors. First, the financial turmoil in advanced economies tends to increase the financial stress in emerging economies. This reflects the financial contagion from advanced economies to emerging economies. Second, domestic financial stress can be also aggravated by common global factors such as changes in commodity prices, GDP growth, and interest rates. Third, country-specific factors such as the degree of openness (financial and trade) and macroeconomic vulnerabilities (current account, fiscal balance, and foreign exchange reserves) also seem to affect individual emerging market FSIs.

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[11] The three regional dummy variables represent emerging Asia, emerging Americas, and emerging Europe, respectively. The intercept for the random-effects generalized least squares estimation for Equation (7) corresponds to the common regional factor of other emerging market economies which includes Egypt, Israel, South Africa, and Turkey.

Previous literature also notes that the transmission can be caused by some common factors which affect individual emerging market FSIs simultaneously. Such common factors can include global shocks and may manifest through investors' herding behavior, cross-country contagion, and common credit conditions. In contrast to the existing studies, this paper argues that there may be some region-specific shocks as well, in line with the observed regional financial integration. These shocks can, in addition to common global shocks, explain the rapid transmission of a financial shock in a particular region, such as regional financial contagion that was experienced in emerging Asia during the financial crisis of 1997–1998 and also emerging Americas in the 1990s and early 2000s.

Table 1 presents the panel estimates on the determinants of emerging market FSI. Specifications (1) to (6) do not include regional dummy variables and are estimated using fixed-effects. Specifications (7) to (12) include regional dummy variables and are estimated using random-effects. Specifications (1) to (3) and (7) to (9) use FSI aggregated using variance-equal weights; while (4) to (6) and (10) to (12) use principal components. Specifications (1), (4), (7), and (10) only include advanced economies FSI; (2), (5), (8), and (11) include other emerging market FSI excluding the specific country FSI; (3), (6), (9), and (12) include emerging market FSI excluding the region and regional FSI excluding the country. Robust standard errors are used and are reported in italics. The results indicate that specifications which include other emerging market FSI as a determinant of domestic FSI have better fit than those which include advanced economies FSI only, as shown by their higher overall R-squared.

Table 1: Full Sample Panel Estimates

Dependent Variable: Emerging Country FSI	Expected Sign	Variance-Equal Weights			Principal Components			Variance-Equal Weights			Principal Components		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Advanced Economies FSI	(+)	0.566*	0.329*	0.346*	0.564*	0.425*	0.413*	0.574*	0.336*	0.353*	0.570*	0.429*	0.420*
		0.05	0.05	0.05	0.05	0.06	0.06	0.04	0.05	0.05	0.05	0.06	0.06
Emerging Economies FSI (excl country)	(+)		0.856*			0.760*			0.853*			0.771*	
			0.10			0.09			0.09			0.09	
Emerging Economies FSI (excl region)	(+)			0.434*			0.313*			0.438*			0.333*
				0.12			0.08			0.12			0.08
Regional FSI (excl country)	(+)			0.420*			0.417*			0.413*			0.403*
				0.12			0.10			0.11			0.10
LIBOR (3-month)	(+)	0.279*	0.262*	0.265*	0.155*	0.160*	0.160*	0.284*	0.252*	0.253*	0.160*	0.156*	0.155*
		0.07	0.06	0.06	0.04	0.04	0.04	0.06	0.06	0.06	0.04	0.04	0.04
Global GDP Growth	(-)	0.235*	-0.115**	-0.098***	0.084	-0.049	-0.051	0.236*	-0.118**	-0.101**	0.082	-0.054	-0.055
		0.05	0.05	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.05
Global Commodity Price Change	(-)	-0.033*	-0.028*	-0.029*	-0.019*	-0.018*	-0.018*	-0.034*	-0.028*	-0.029*	-0.020*	-0.018*	-0.018*
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Financial Openness (t-1)	(+)	0.002*	0.002*	0.002*	0.002*	0.002**	0.002**	0.001	0.001	0.001	0.001***	0.001***	0.001***
		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trade Openness (t-1)	(-)	-0.011	-0.004	-0.003	-0.010**	-0.007	-0.006	-0.002	-0.002	-0.002	-0.003	-0.004***	-0.003
		0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Current Account (t-1)	(-)	-0.035	-0.019	-0.015	-0.045**	-0.028	-0.030	-0.007	0.005	0.008	-0.018	-0.005	-0.005
		0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
Fiscal Balance (t-1)	(-)	-0.065**	-0.047*	-0.047**	-0.045**	-0.040**	-0.043**	-0.047**	-0.035**	-0.035**	-0.031**	-0.030**	-0.030**
		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01
ΔForeign Exchange Reserves (t-1)	(-)	-0.012	0.009	0.009	-0.027	-0.018	-0.017	-0.015	0.007	0.007	-0.028***	-0.018	-0.017
		0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01
Dummy Emerging Asia	(+)							0.014	-0.099	-0.078	0.200**	0.143	0.151***
								0.18	0.16	0.16	0.09	0.09	0.08
Dummy Emerging Americas	(+)							0.156	0.067	0.090	0.108	0.091	0.086
								0.21	0.18	0.18	0.10	0.09	0.08
Dummy Emerging Europe	(+)							-0.237	-0.224	-0.109	0.203	0.286***	0.220
								0.22	0.20	0.22	0.15	0.15	0.17
Constant		-0.938	-0.506	-0.587	-0.148	-0.056	-0.103	-1.406*	-0.286	-0.352	-0.703*	-0.263	-0.243
		0.73	0.62	0.63	0.37	0.35	0.35	0.31	0.27	0.28	0.24	0.21	0.22
R-squared (overall)		0.257	0.418	0.419	0.196	0.315	0.325	0.293	0.436	0.439	0.255	0.339	0.346
Observations		1845	1845	1837	1840	1840	1832	1845	1845	1837	1840	1840	1832
Country		25	25	25	25	25	25	25	25	25	25	25	25
Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No

Note: *, **, *** significant at 0.01, 0.05, and 0.10, respectively.

Source: Authors' estimate.

For robustness checks, dataset for each region is estimated separately. The results are shown in Tables 2–4 for emerging Asia, emerging Americas, and emerging Europe, respectively. Specifications (1) to (3) use FSI aggregated using variance-equal weights; while (4) to (6) use principal components. Specifications (1) and (4) only include advanced economies FSI; (2) and (5) include other emerging market FSI excluding the specific country FSI; (3) and (6) include emerging market FSI excluding the region and regional FSI excluding the country. All specifications were estimated using fixed-effects to account for country heterogeneity. Robust standard errors are used and are reported in italics. Similar to the results in Table 1, specifications which include other emerging market FSI as a determinant of domestic FSI have better fit than those which include advanced economies FSI only.

Table 2: Emerging Asia, Fixed Effects Panel Estimates

Dependent Variable: Emerging Asia Country FSI	Expected Sign	Variance-Equal Weights			Principal Components		
		(1)	(2)	(3)	(4)	(5)	(6)
Advanced Economies FSI	(+)	0.482*	0.254*	0.297*	0.428*	0.301*	0.337*
		0.05	0.07	0.05	0.04	0.05	0.04
Emerging Economies FSI (excl country)	(+)		1.024*			0.734*	
			0.16			0.13	
Emerging Economies FSI (excl region)	(+)			0.334***			0.199***
				0.15			0.09
Regional FSI (excl country)	(+)			0.636**			0.555*
				0.22			0.14
LIBOR (3-month)	(+)	0.279**	0.256**	0.263**	0.123***	0.124***	0.145**
		0.10	0.09	0.10	0.06	0.06	0.06
Global GDP Growth	(-)	0.279**	-0.076	-0.083	0.019	-0.097	-0.077
		0.10	0.08	0.08	0.11	0.10	0.10
Global Commodity Price Change	(-)	−0.042**	−0.036*	−0.034*	−0.020**	−0.019**	−0.019**
		0.01	0.01	0.01	0.01	0.01	0.01
Financial Openness (t-1)	(+)	0.002***	0.002***	0.002**	0.002**	0.002**	0.002**
		0.00	0.00	0.00	0.00	0.00	0.00
Trade Openness (t-1)	(-)	−0.004	0.000	−0.001	−0.005	−0.003	−0.005
		0.01	0.01	0.01	0.01	0.01	0.01
Current Account (t-1)	(-)	−0.035	−0.020	−0.020	−0.051***	−0.033	−0.031
		0.04	0.04	0.04	0.03	0.03	0.03
Fiscal Balance (t-1)	(-)	−0.040	−0.031	−0.034	−0.023***	−0.021	−0.026***
		0.03	0.02	0.02	0.01	0.01	0.01
ΔForeign Exchange Reserves (t-1)	(-)	0.007	0.022	0.019	−0.019	−0.012	−0.011
		0.02	0.01	0.01	0.02	0.02	0.02
Constant		−1.325	−0.952	−0.814	−0.111	−0.089	−0.019
		1.30	1.00	0.99	0.72	0.68	0.71
R-squared (overall)		0.231	0.376	0.392	0.194	0.248	0.270
Observations		804	804	804	804	804	804
Country		10	10	10	10	10	10
Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: *, **, *** significant at 0.01, 0.05, and 0.10, respectively.

Source: Authors' estimate.

Table 3: Emerging Americas Fixed Effects Panel Estimates

Dependent Variable: Emerging Americas Country FSI	Expected Sign	Variance-Equal Weights			Principal Components		
		(1)	(2)	(3)	(4)	(5)	(6)
Advanced Economies FSI	(+)	0.651*	0.433**	0.461**	0.635*	0.519**	0.502**
		0.11	0.15	0.16	0.12	0.14	0.15
Emerging Economies FSI (excl country)	(+)		0.908**			0.899*	
			0.19			0.13	
Emerging Economies FSI (excl region)	(+)			0.629***			0.519**
				0.30			0.16
Regional FSI (excl country)	(+)			0.256***			0.317*
				0.11			0.04
LIBOR (3-month)	(+)	0.437**	0.441**	0.423**	0.196**	0.220**	0.205**
		0.16	0.14	0.13	0.07	0.06	0.06
Global GDP Growth	(-)	0.128	-0.222***	-0.202	0.032	-0.106	-0.101
		0.10	0.10	0.12	0.08	0.07	0.07
Global Commodity Price Change	(-)	−0.024**	-0.022**	-0.022**	-0.014**	-0.015**	-0.014**
		0.01	0.01	0.00	0.00	0.00	0.01
Financial Openness (t-1)	(+)	0.014*	0.011**	0.011**	0.006***	0.005	0.005
		0.00	0.00	0.00	0.00	0.00	0.00
Trade Openness (t-1)	(-)	−0.037***	-0.027	-0.035	-0.021**	-0.014	-0.017
		0.01	0.02	0.03	0.01	0.01	0.02
Current Account (t-1)	(-)	−0.078	0.055	0.050	-0.089***	-0.001	-0.011
		0.07	0.06	0.07	0.04	0.04	0.04
Fiscal Balance (t-1)	(-)	−0.124***	-0.047	-0.027	-0.094**	-0.071**	-0.059
		0.06	0.05	0.05	0.03	0.03	0.04
ΔForeign Exchange Reserves (t-1)	(-)	−0.115	-0.028	-0.030	-0.045	-0.020	-0.020
		0.08	0.08	0.07	0.06	0.06	0.06
Constant		−1.854	-0.762	-0.484	-0.721	-0.407	-0.262
		1.18	0.78	0.83	0.71	0.73	0.95
R-squared (overall)		0.352	0.482	0.473	0.341	0.444	0.438
Observations		440	440	432	435	435	427
Country		6	6	6	6	6	6
Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: *, **, *** significant at 0.01, 0.05, and 0.10, respectively.

Source: Authors' estimate.

Table 4: Emerging Europe Fixed Effects Panel Estimates

Dependent Variable: Emerging Europe Country FSI	Expected Sign	Variance-Equal Weights			Principal Components		
		(1)	(2)	(3)	(4)	(5)	(6)
Advanced Economies FSI	(+)	0.643*	0.352**	0.355*	0.652*	0.371**	0.368***
		0.11	0.06	0.07	0.10	0.12	0.13
Emerging Economies FSI (excl country)	(+)		0.666**			1.084*	
			0.17			0.12	
Emerging Economies FSI (excl region)	(+)			0.480**			0.533**
				0.14			0.13
Regional FSI (excl country)	(+)			0.233**			0.519**
				0.08			0.14
LIBOR (3-month)	(+)	0.185**	0.224**	0.231**	0.169***	0.234**	0.215***
		0.05	0.05	0.05	0.07	0.07	0.08
Global GDP Growth	(-)	0.219	−0.127	−0.125	0.168	−0.052	−0.076
		0.16	0.13	0.12	0.13	0.10	0.10
Global Commodity Price Change	(-)	−0.019***	−0.019**	−0.020**	−0.021**	−0.023**	−0.021**
		0.01	0.01	0.01	0.01	0.00	0.01
Financial Openness (t-1)	(+)	0.005*	0.007*	0.007*	0.000	0.002	0.001
		0.00	0.00	0.00	0.00	0.00	0.00
Trade Openness (t-1)	(-)	−0.052**	−0.040**	−0.036**	−0.041**	−0.034**	−0.018
		0.01	0.01	0.01	0.01	0.01	0.01
Current Account (t-1)	(-)	0.042	−0.011	−0.009	0.047**	0.003	−0.002
		0.02	0.02	0.03	0.01	0.01	0.01
Fiscal Balance (t-1)	(-)	−0.026	−0.028	−0.029	−0.037	−0.048	−0.047
		0.03	0.02	0.02	0.05	0.04	0.03
ΔForeign Exchange Reserves (t-1)	(-)	0.002	0.010	0.016	−0.022	−0.011	−0.015
		0.03	0.03	0.03	0.02	0.02	0.02
Constant		2.245*	1.677***	1.435	2.724**	2.314**	1.118
		0.98	0.78	0.75	0.60	0.68	0.98
R-squared (overall)		0.170	0.402	0.433	0.211	0.434	0.582
Observations		306	306	306	306	306	306
Country		5	5	5	5	5	5
Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes

Note: *, **, *** significant at 0.01, 0.05, and 0.10, respectively.

Source: Authors' estimate.

The estimates presented in Table 1 offer several key findings. First, financial stress from both advanced and emerging market economies (excluding a country), significantly increases domestic FSI for the (excluded) emerging market economy. This finding is consistent with that Balakrishnan et al. (2011). The estimates also show that emerging market (excluding the particular region) and regional FSIs (excluding the particular country) significantly increases domestic FSI as seen in specifications (3), (6), (9), and (12). These findings support the view that financial contagion could originate from both advanced and other emerging economies.

Second, both global and domestic factors significantly influence domestic FSI. Higher global interest rates tend to increase domestic financial stress, suggesting tightening conditions in international credit markets can have adverse effects on the domestic financial condition. Higher global GDP growth reduces domestic financial stress, implying that as global demand conditions improve financial stress declines. In contrast, sound domestic macroeconomic conditions have mitigating effect on domestic financial stress. Current account surplus, fiscal surplus, and higher foreign exchange reserves lower domestic financial stress. Among these domestic indicators, fiscal surplus significantly lowers domestic FSI across specifications. This means that fiscal space of the country or its ability to increase domestic spending during episodes of financial market turmoil remains crucial in lowering domestic financial stress.

Third, trade and financial openness are both significant but have opposing influence on domestic FSI. Greater de facto financial integration tends to significantly increase domestic financial stress; while greater trade openness reduces it. These findings are consistent with the existing view that financial openness can increase emerging market countries' vulnerability to financial shocks through increased capital flows and volatility. Greater trade openness tends to improve economic performance, while diversified trading partners could positively influence economic stability, thereby reducing domestic FSI.

Fourth, the effects of dummy variables for different regions are also found significant for emerging Asia and emerging Europe, suggesting that a common regional factor also plays an important role in driving domestic financial stress in these emerging market countries. While it is difficult to pin down what this common regional factor represents, it could be similar economic fundamentals, institutional set ups, and whatever about the region that causes common perception and herding behaviour of foreign investors. This finding also suggests that both regions are vulnerable to financial contagion within the region, wherein a crisis in one member country will have significant impact on the other countries in the region. The experience of emerging Asia during the 1997–1998 financial crisis concurs with this finding.[12]

Fifth, the results are robust when one looks into the fixed-effects estimates for the emerging market regions. Tables 2–4 present the results for emerging Asia, emerging Americas, and emerging Europe, respectively. As in the full sample results, advanced economies FSI and emerging market FSI (excluding the particular country) significantly increases domestic emerging market FSI of the particular country. Furthermore, regional emerging market FSI (excluding the particular country) is also a significant determinant of domestic FSI of the particular country. Interestingly, unlike for emerging Americas and emerging

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[12] To check for the robustness of the results, a separate regression was made where calm periods were dropped to focus only on periods of high financial stress in emerging markets. The results show that the dummy variable for emerging Americas is significant; implying that during periods of financial stress, regional factor is significant for emerging Americas. We also conducted a separate regression by removing the Hong Kong, China and Singapore, both of which are considered as the Asian financial hub in the emerging Asia sample, to determine whether the significance of a common Asian regional factor is due to the inclusion of these two financial hubs. The panel regression results show that a common Asian regional factor is still positive and significant.

Europe, trade openness is insignificant for emerging Asia. But unlike emerging Asia and emerging Americas, fiscal surplus is insignificant for emerging Europe.

IV. IMPACT OF ADVANCED AND OTHER EMERGING MARKET FINANCIAL SHOCKS ON DOMESTIC EMERGING MARKET FSI

Knowing that advanced and other emerging market economies FSI significantly increase domestic FSI, we can examine the magnitude and persistence of financial shocks coming from advanced and other emerging economies on domestic FSI using a structural vector autoregression (SVAR) with contemporaneous or short-run restrictions.

A. Structural Vector Autoregression

The SVAR model used in this paper takes a structural equation form, given by:

$$A(L)Y_t = e_t \qquad (8)$$

where $A(L)$ is a matrix of polynomial in the lag operator L. Y_t is a 3 x 1 data vector corresponding to advanced economies FSI, other emerging market countries FSI (excluding the particular country), and domestic FSI.[13] e_t is a 3 x 1 structural disturbance. The reduce-form equation is given by:

$$Y_t = B(L)Y_{t-1} + \mu_t \qquad (9)$$

where $B(L)$ is a matrix polynomial in lag operator L and $Var(u_t) = \Omega$. To recover the parameters and structural shocks in equation (8), contemporaneous short-run identifying restrictions are imposed, following Blanchard and Watson (1986); Bernanke (1986); and Sims (1986). The orthogonal factorization matrixes are given the form:

$$A = \begin{pmatrix} 1 & 0 & 0 \\ NA & 1 & 0 \\ NA & NA & 1 \end{pmatrix}, \quad B = \begin{pmatrix} NA & 0 & 0 \\ 0 & NA & 0 \\ 0 & 0 & NA \end{pmatrix}.$$

$$(10)$$

such that domestic FSI responds to advance and emerging market countries financial shocks; as well as its own financial shocks (third row of matrix A); while its covariance with advanced and other emerging market financial shocks is assumed zero (third row of matrix B). The resulting impulse response functions and variance decomposition will show the size, speed of adjustment, and persistence of impact of advanced and other emerging market countries (nonregional and regional) financial shocks on domestic emerging market FSI.

To estimate equations (8) to (10), an augmented ADF unit root test was conducted for financial stress indexes for advanced economies, emerging market (excluding the particular country), non-regional emerging market, regional excluding the country, and domestic FSI using both variance-equal weights and principal component analysis. The results reject the null hypothesis of a unit root at 0.10 level of significance for almost all countries; except for Czech

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[13] A separate structural vector autoregression model is also estimated decomposing other emerging market countries FSI into nonregional and regional emerging market FSI. The same procedure would apply for the four-variable SVAR.

Republic, Egypt, and Romania. Since most FSI indicators do not contain unit root, SVAR was estimated using the level data for all FSI indexes. A granger causality test has also been done, and the results does not reject the null hypothesis that domestic FSI *does not Granger cause* both the advanced and other emerging market FSIs.

To determine the appropriate lag order to use in the SVAR, lag structure test was conducted using the financial predictor error, Akaike information criterion, Schwarz information criterion, and Hannan-Quinn information criterion. The results from the lag order test show that up to two lags of each variable must be included in the SVAR estimation.

B.   Impulse Responses and Variance Decompositions

Figures 5a to 5y present individual emerging market impulse responses of domestic FSI to a structural one standard deviation financial shock coming from advanced economies (Shock 1), other emerging markets (Shock 2), and its own domestic market (Shock 3) using both variance-equal weights and principal component analysis. The responses are shown together with their +/– two standard error values. Table 5 shows the variance decompositions of domestic FSI on financial shocks coming from advanced economies (Shock 1), other emerging markets (Shock 2), and its own domestic market (Shock 3). Figures 6a to 6y present individual emerging market impulse responses of domestic FSI to a structural one standard deviation financial shock coming from advanced economies (Shock 1), nonregional emerging markets (Shock 2), regional emerging markets excluding the country (Shock 3), and its own domestic market (Shock 4) using both variance-equal weights and principal component analysis. Table 6 presents the variance decompositions.

Table 5: Variance Decomposition of Domestic FSI

a) Emerging Markets				
Period	**S.E.**	**Shock1**	**Shock2**	**Shock3**
Financial Stress Index (Equal-Variance)				
1	1.035	11.935	8.905	79.160
2	1.540	16.003	13.992	70.005
3	1.792	16.858	18.871	64.272
4	1.901	16.547	22.482	60.971
6	1.962	16.263	25.558	58.179
8	1.973	16.515	26.125	57.361
12	1.979	16.792	26.205	57.003
Financial Stress Index (Principal Component)				
1	0.589	10.231	6.826	82.943
2	0.873	12.110	11.681	76.209
3	1.023	12.248	16.686	71.067
4	1.097	11.991	20.486	67.523
6	1.148	12.173	23.153	64.674
8	1.157	12.558	23.234	64.208
12	1.162	12.908	22.995	64.097

b) Emerging Asia				
Period	S.E.	Shock1	Shock2	Shock3
Financial Stress Index (Equal-Variance)				
1	1.025	8.643	14.410	76.947
2	1.528	10.831	19.447	69.721
3	1.780	10.514	23.510	65.976
4	1.883	9.997	25.954	64.049
6	1.929	10.485	27.186	62.329
8	1.934	11.400	26.944	61.656
12	1.936	12.140	26.649	61.211
Financial Stress Index (Principal Component)				
1	0.578	7.735	7.069	85.195
2	0.860	8.791	11.555	79.654
3	1.010	8.680	15.316	76.004
4	1.081	8.858	17.601	73.542
6	1.120	10.097	18.606	71.298
8	1.125	10.777	18.472	70.752
12	1.126	11.014	18.413	70.572

c) Emerging Americas				
Period	S.E.	Shock1	Shock2	Shock3
Financial Stress Index (Equal-Variance)				
1	1.025	8.784	8.824	82.392
2	1.515	11.518	14.549	73.933
3	1.752	11.984	20.473	67.543
4	1.860	11.459	25.575	62.966
6	1.938	11.067	30.720	58.213
8	1.955	11.371	32.136	56.493
12	1.963	11.695	32.618	55.687
Financial Stress Index (Principal Component)				
1	0.599	8.892	10.993	80.114
2	0.875	10.645	17.257	72.098
3	1.017	10.426	24.896	64.678
4	1.089	9.574	31.308	59.119
6	1.149	8.905	36.276	54.819
8	1.164	8.965	36.823	54.211
12	1.171	9.134	36.820	54.046

d) Emerging Europe				
Period	S.E.	Shock1	Shock2	Shock3
Financial Stress Index (Equal-Variance)				
1	1.064	16.064	2.218	81.719
2	1.591	26.582	7.447	65.971
3	1.862	30.703	12.114	57.182
4	1.987	31.104	15.235	53.661
6	2.065	29.848	17.678	52.474
8	2.083	29.152	18.043	52.805
12	2.095	28.692	18.169	53.139
Financial Stress Index (Principal Component)				
1	0.596	13.035	5.202	81.763
2	0.893	17.623	9.227	73.150
3	1.054	19.194	14.062	66.744
4	1.143	19.071	18.504	62.425
6	1.212	18.334	22.245	59.420
8	1.227	18.378	22.134	59.488
12	1.239	19.060	21.145	59.796

| e) Other Emerging Markets				
Period	S.E.	Shock1	Shock2	Shock3
Financial Stress Index (Equal-Variance)				
1	1.041	19.731	3.625	76.644
2	1.545	22.436	7.702	69.862
3	1.796	22.720	13.313	63.967
4	1.901	22.360	18.221	59.419
6	1.953	21.521	23.596	54.884
8	1.960	21.222	25.161	53.617
12	1.963	21.192	25.523	53.285
Financial Stress Index (Principal Component)				
1	0.594	14.974	1.999	83.027
2	0.876	15.716	6.696	77.588
3	1.024	15.218	11.073	73.709
4	1.094	14.601	13.945	71.454
6	1.133	14.565	15.970	69.465
8	1.139	15.124	16.134	68.742
12	1.142	15.612	16.026	68.362

Note: Factoralization is structural. Values refer to unweighted average of individual country variance decomposition.

Source: Authors' calculation.

Table 6: Variance Decomposition of Domestic FSI

a) Emerging Markets					
Period	S.E.	Shock1	Shock2	Shock3	Shock4
Financial Stress Index (Equal-Variance)					
1	1.037	12.762	5.149	7.245	74.844
2	1.551	17.140	8.736	9.133	64.991
3	1.802	17.778	12.314	11.064	58.844
4	1.912	17.150	15.254	12.556	55.040
6	1.979	16.520	17.973	14.129	51.377
8	1.993	16.766	18.504	14.752	49.978
12	2.006	17.145	18.582	15.134	49.139
Financial Stress Index (Principal Component)					
1	0.593	11.031	3.880	5.939	79.151
2	0.881	12.863	6.886	8.864	71.387
3	1.034	12.866	10.501	10.913	65.721
4	1.111	12.447	13.760	12.259	61.535
6	1.165	12.462	16.422	13.591	57.526
8	1.176	12.770	16.515	14.355	56.360
12	1.183	13.048	16.245	15.005	55.703

b) Emerging Asia						d) Emerging Europe					
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Period	S.E.	Shock1	Shock2	Shock3	Shock4
Financial Stress Index (Equal-Variance)						**Financial Stress Index** (Equal-Variance)					
1	1.038	9.436	7.022	12.094	71.448	1	1.058	14.954	1.333	3.960	79.753
2	1.551	11.735	8.669	17.292	62.304	2	1.590	25.672	6.614	3.435	64.278
3	1.803	11.314	10.433	20.815	57.438	3	1.845	29.230	10.341	4.198	56.230
4	1.907	10.612	11.689	22.863	54.835	4	1.963	29.307	12.958	6.145	51.590
6	1.954	10.975	12.449	24.062	52.514	6	2.048	27.654	14.695	10.623	47.028
8	1.960	12.111	12.411	23.840	51.638	8	2.076	26.920	14.338	13.285	45.458
12	1.962	12.915	12.378	23.527	51.180	12	2.113	26.965	13.865	14.891	44.280
Financial Stress Index (Principal Component)						**Financial Stress Index** (Principal Component)					
1	0.581	8.555	2.836	8.366	80.242	1	0.600	12.809	3.882	4.117	79.192
2	0.865	9.567	3.716	14.776	71.941	2	0.903	17.283	7.405	4.876	70.436
3	1.016	9.374	5.139	18.347	67.139	3	1.068	18.781	11.151	6.806	63.262
4	1.089	9.465	6.371	20.110	64.053	4	1.159	18.647	14.481	9.192	57.680
6	1.132	10.609	7.259	20.630	61.503	6	1.230	18.036	16.712	13.496	51.755
8	1.137	11.284	7.319	20.503	60.894	8	1.249	17.915	16.003	16.461	49.621
12	1.140	11.446	7.363	20.467	60.724	12	1.268	18.575	14.677	19.007	47.740
c) Emerging Americas						e) Other Emerging Markets					
Period	S.E.	Shock1	Shock2	Shock3	Shock4	Period	S.E.	Shock1	Shock2	Shock3	Shock4
Financial Stress Index (Equal-Variance)						**Financial Stress Index** (Equal-Variance)					
1	1.011	10.133	7.148	6.295	76.424	1	1.047	22.285	2.237	0.652	74.826
2	1.511	13.308	12.129	5.740	68.823	2	1.563	25.733	6.466	0.946	66.855
3	1.753	13.552	17.963	5.635	62.850	3	1.822	25.962	11.011	3.411	59.616
4	1.869	12.721	23.454	5.373	58.452	4	1.927	24.942	14.736	5.579	54.744
6	1.962	11.786	29.445	4.990	53.778	6	1.979	23.567	18.675	7.386	50.372
8	1.983	11.800	31.216	5.059	51.925	8	1.990	23.163	19.874	8.405	48.558
12	1.994	12.010	31.773	5.242	50.974	12	1.995	23.146	20.202	9.297	47.355
Financial Stress Index (Principal Component)						**Financial Stress Index** (Principal Component)					
1	0.605	10.738	6.985	7.266	75.012	1	0.596	13.411	1.498	1.953	83.138
2	0.887	12.173	11.448	7.440	68.939	2	0.898	15.100	6.502	2.070	76.329
3	1.031	11.565	18.421	7.166	62.849	3	1.058	15.473	11.656	3.233	69.638
4	1.105	10.251	25.454	6.775	57.521	4	1.138	15.281	15.952	4.483	64.285
6	1.171	8.974	32.070	6.588	52.368	6	1.190	15.585	19.244	6.441	58.731
8	1.189	8.898	32.943	6.852	51.306	8	1.202	16.481	19.083	7.721	56.715
12	1.196	9.034	32.944	6.990	51.032	12	1.219	17.791	18.341	8.810	55.058

Note: Factoralization is structural. Values refer to unweighted average of individual country variance decomposition.

Source: Authors' calculation.

Based on the impulse responses and variance decomposition results, several key findings are noted. First, the impulse responses from the SVAR model on the impact of advanced economies, other emerging markets, and domestic market financial shocks on domestic FSI (Figures 5a to 5y) are in line with the panel regression results. Specifically, financial shocks originating from advanced and other emerging market countries increase individual emerging market domestic FSI. Among the different sources of financial shocks, domestic FSI tends to respond strongly to its own financial shock. However, some emerging market domestic FSIs respond faster to a shock of advance economies compared to that of emerging market; while others (mostly emerging Asia) respond more strongly to a shock of emerging market than to that of advance economies. Hence, there are differences in speed and magnitude of responses to external financial shocks across individual emerging market countries.

Figure 5: Impulse Responses of Domestic FSI
(Response to Structural One S.D. ± 2 S.E.)
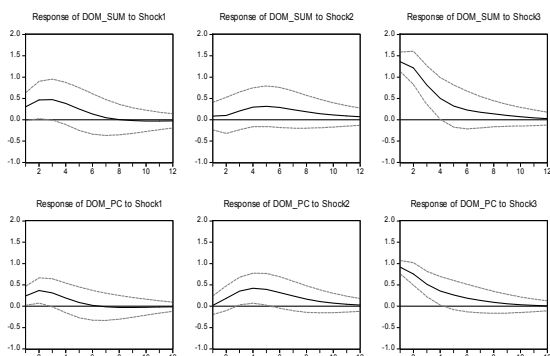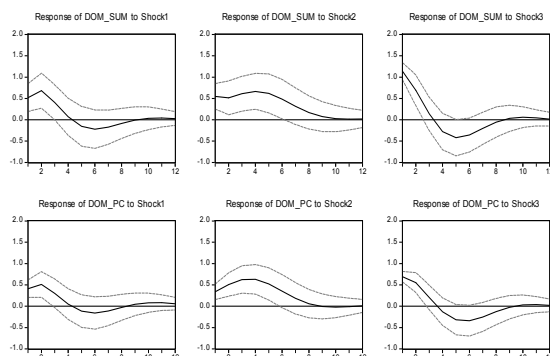
a. Argentina

b. Brazil

c. Chile

d. People's Rep. of China

e. Colombia

f. Czech Republic

g. Egypt

h. Hong Kong, China
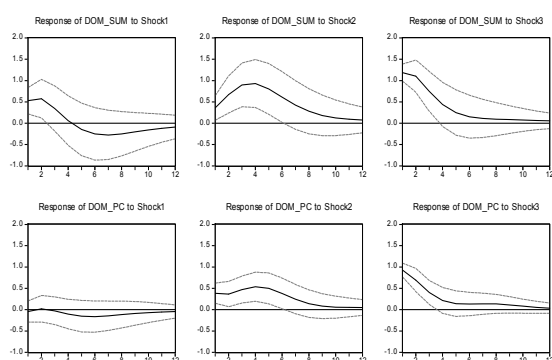
i. Hungary

j. India

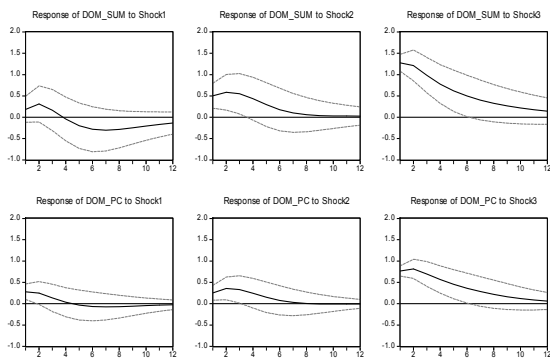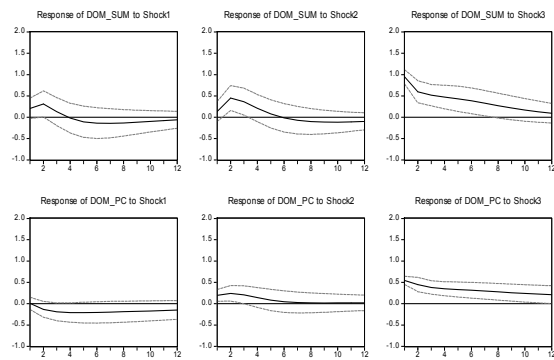k. Indonesia

l. Israel

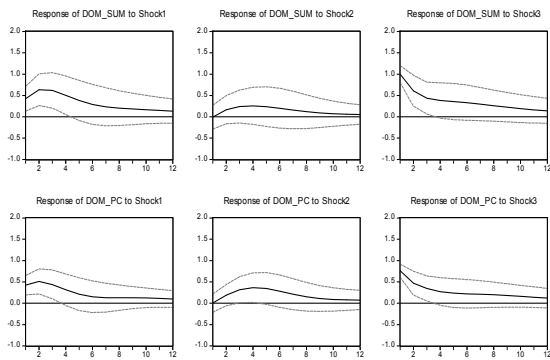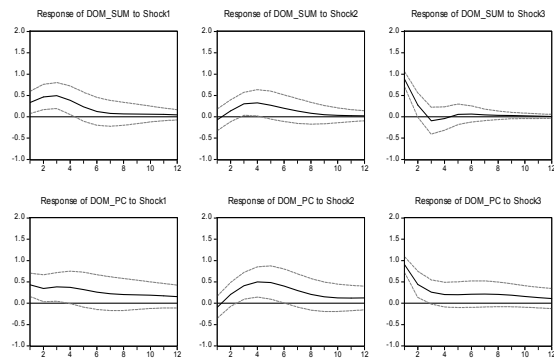m. Rep. of Korea
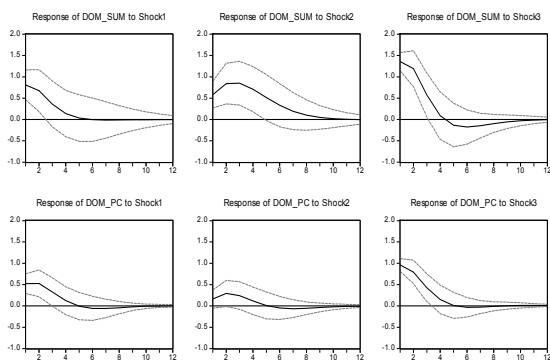

n. Malaysia

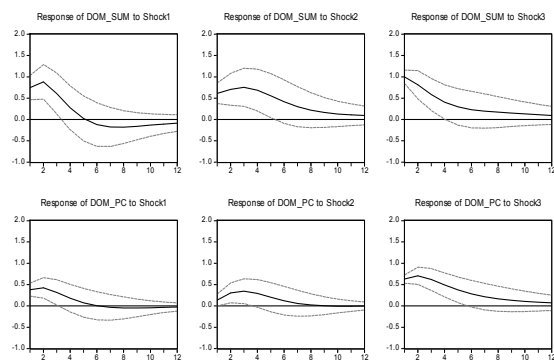
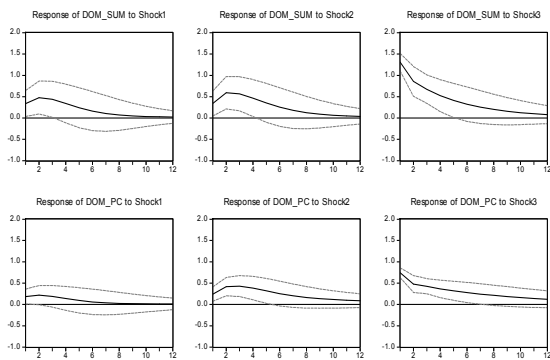o. Mexico
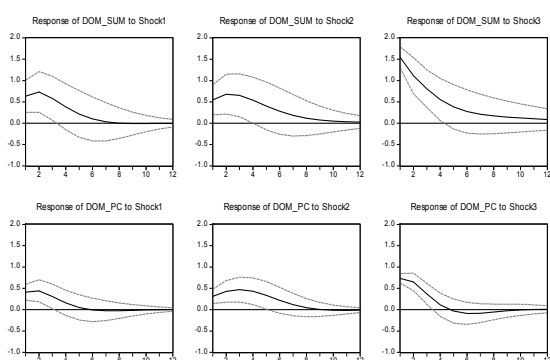
p. Peru
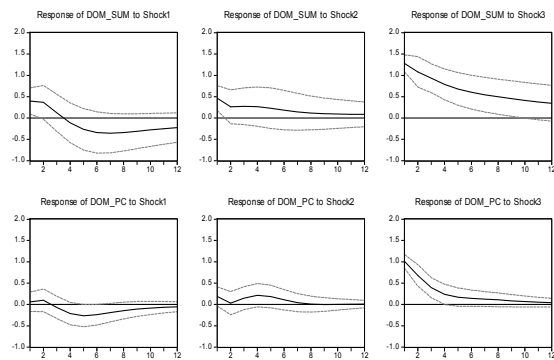
q. Philippines

r. Poland
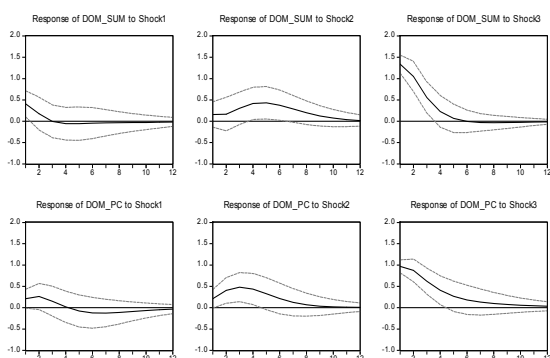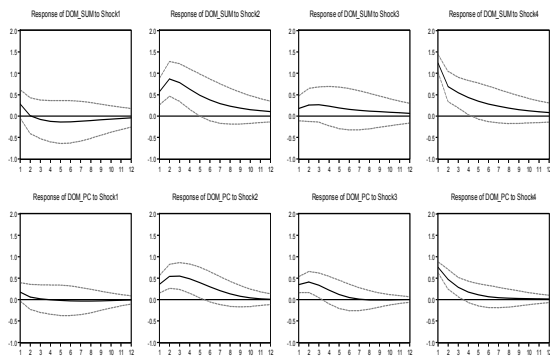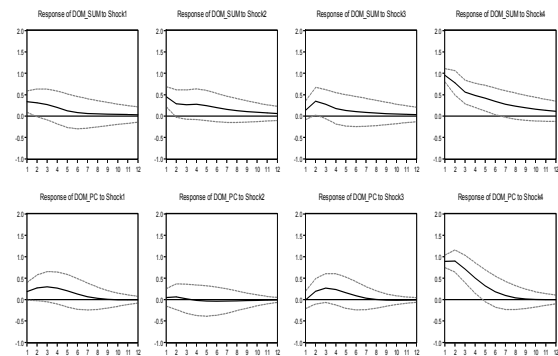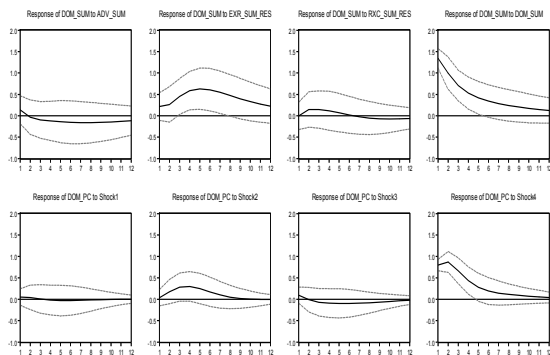
s. Romania

t. Russian Federation

u. South Africa

v. Singapore

w. Taipei,China

x. Thailand

y. Turkey

Note: PC = principal components; SUM = variance-equal weights. The blue line refers to the actual structural response; while the red lines below and above of the actual response corresponds to the +2 and -2 standard errors, respectively.

Source: Authors' estimate.

Second, the variance decompositions in Table 5 show that domestic financial shock dominates variation in domestic FSI. A financial shock from advanced economies accounts for greater variation in domestic FSI in the first two quarters after the shock, while a shock from emerging market economies accounts for greater variation after the second quarter. This suggests that advanced economies financial shock has more instantaneous but less persistent impact on domestic financial stress; while emerging market financial shock has delayed but relatively lasting impact on domestic financial stress. Advanced economies' financial shock accounts for greater variation in domestic FSI during the first four quarters in emerging Europe and several other emerging market economies including Turkey and South Africa; while emerging markets' financial shock explains greater variation in domestic FSI beyond the fourth quarter. For emerging Asia and emerging Americas, a financial shock originating from emerging markets consistently accounts for greater variation in domestic FSI than that coming from advanced countries.

Third, looking into the responses of domestic FSI to financial shocks from other emerging countries excluding the region (nonregional) and regional emerging countries excluding the country (Figures 6a to 6y), the estimates reveal that a shock from nonregional emerging markets increase domestic financial FSI as much as a regional shock or more for many emerging market countries in the sample. But for most emerging Asia, a shock from regional emerging markets has greater impact than that from nonregional emerging markets.[14] The variance decompositions also illustrate that for emerging Asia, regional (excluding country) financial shocks explain considerably larger variation in domestic FSI than nonregional shocks. These observations are consistent with the panel regression estimates showing the significance of a common regional factor for emerging Asia.

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[14] A separate SVAR estimation was conducted by removing the Hong Kong, China and Singapore (both Asian financial hub) in the emerging Asia sample, to determine whether a regional financial shock will still dominate compared to a nonregional shock. The impulse response and variance decomposition results show that a regional financial shock is still greater than nonregional shock despite removing the regional financial hubs.

Figure 6: Impulse Responses of Domestic FSI
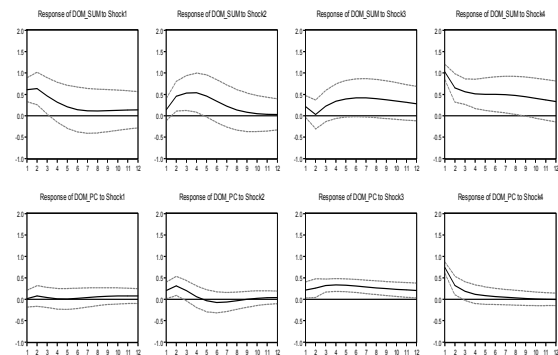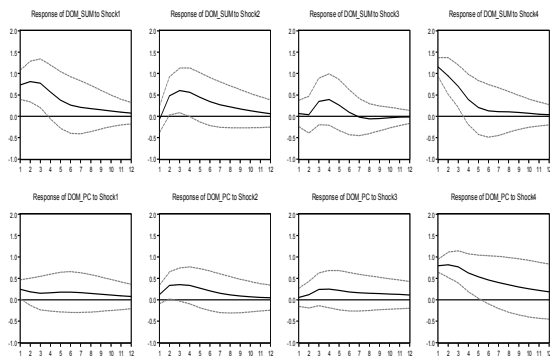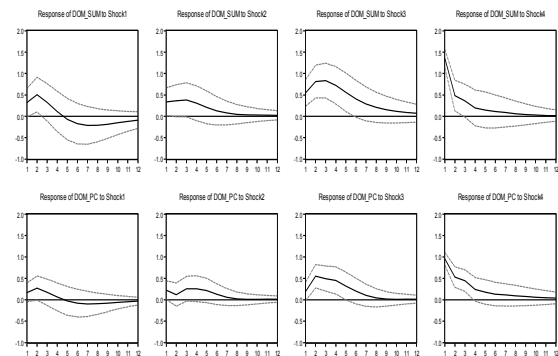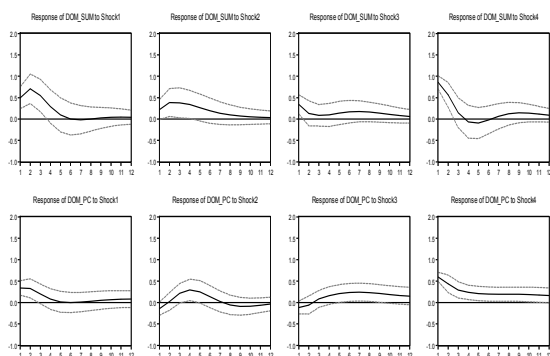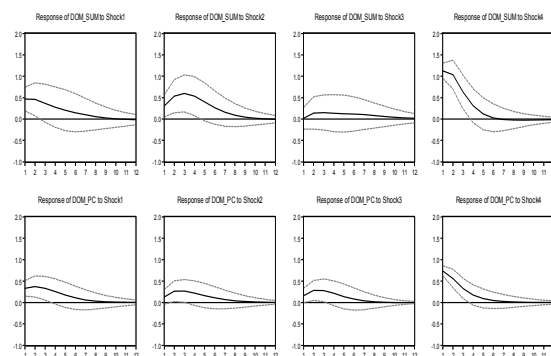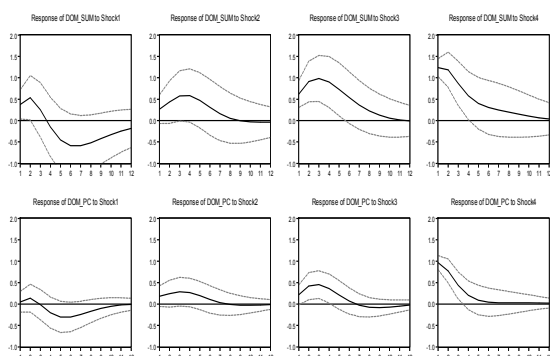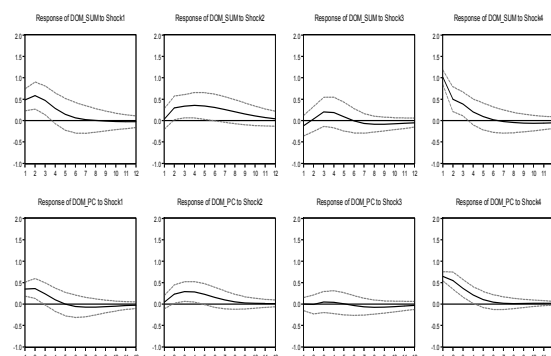(Response to Structural One S.D. ± 2 S.E.)
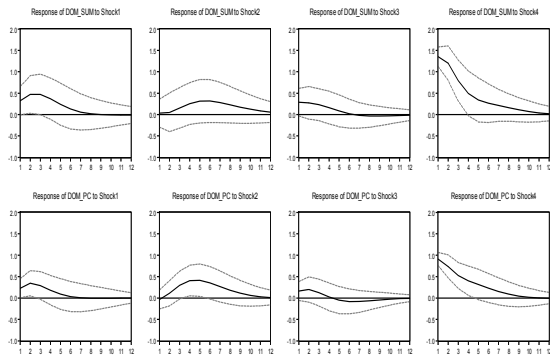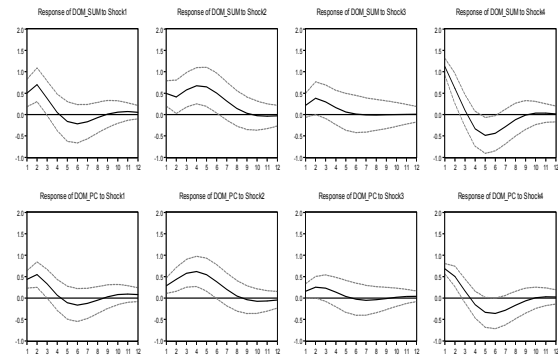
a. Argentina

b. Brazil

c. Chile

d. People's Rep. of China

e. Colombia

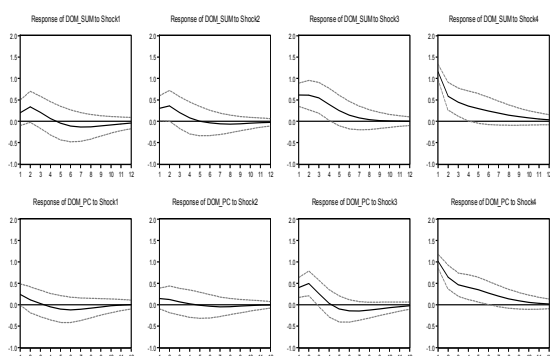f. Czech Republic

g. Egypt

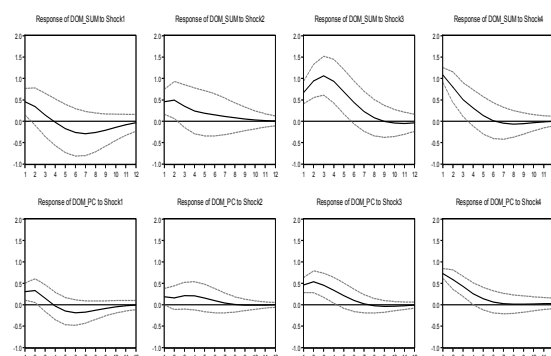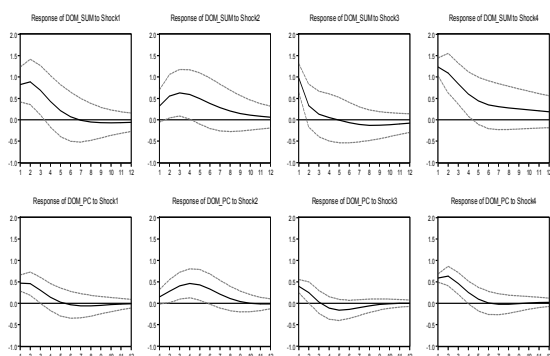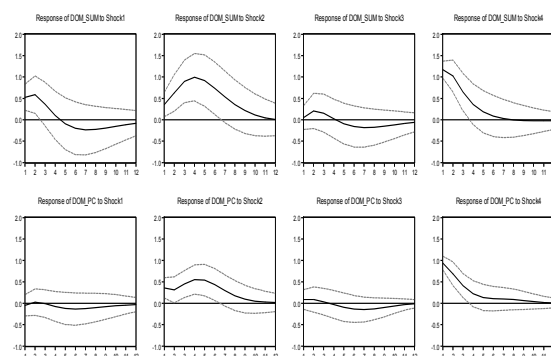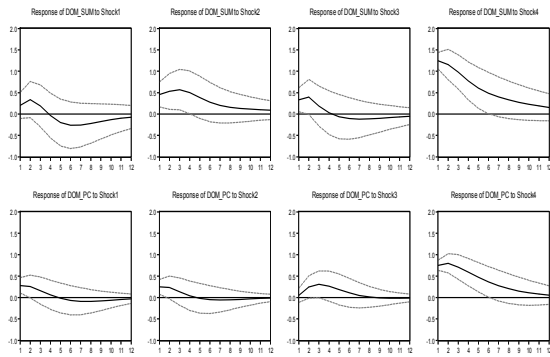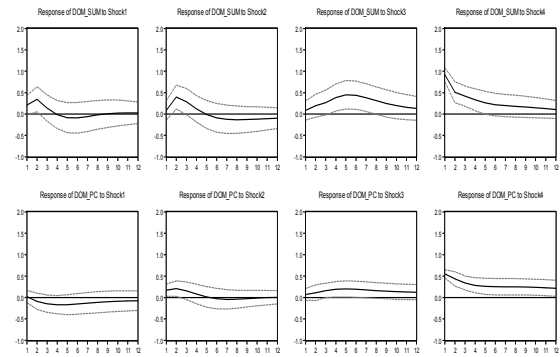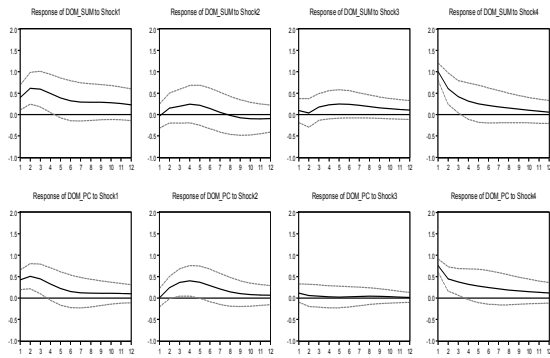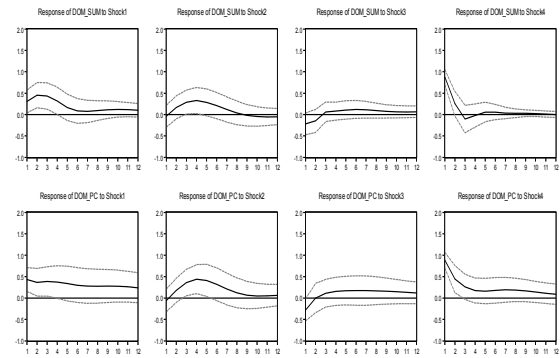h. Hong Kong, China

i. Hungary

j. India

k. Indonesia

l. Israel

m. Rep. of Korea

n. Malaysia

o. Mexico

p. Peru

q. Philippines

r. Poland
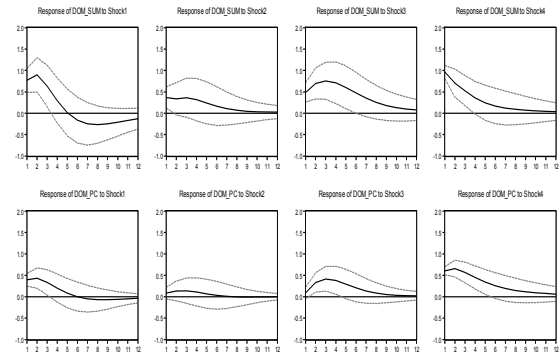

s. Romania
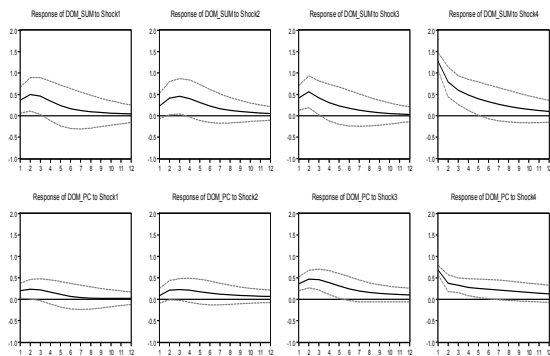

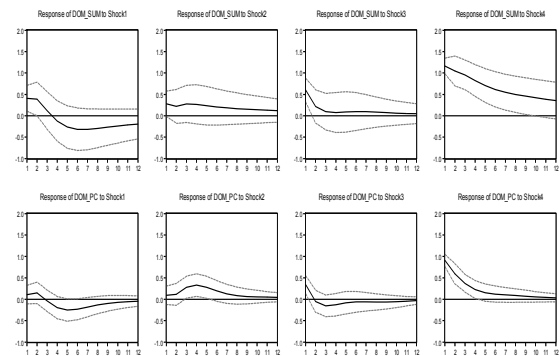## t. Russian Federation

u. South Africa
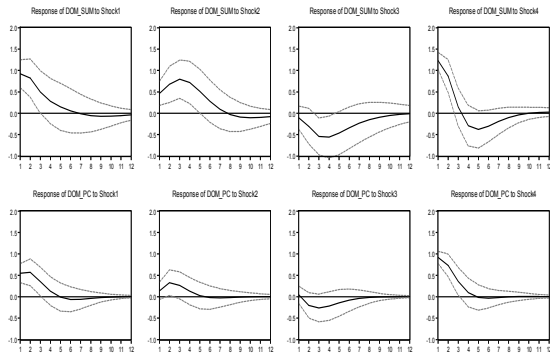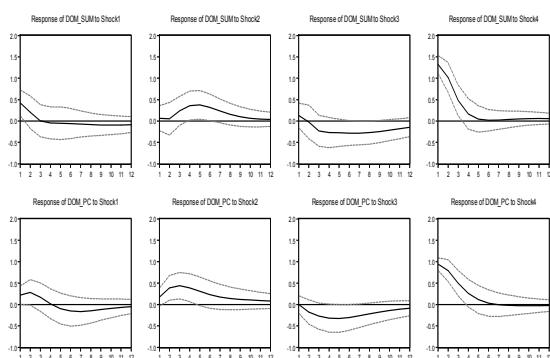

v. Singapore

w. Taipei,China

x. Thailand

y. Turkey

Note: PC = principal components; SUM = variance-equal weights. The blue line refers to the actual structural response; while the red lines below and above of the actual response corresponds to the +2 and –2 standard errors, respectively.

Source: Authors' estimate.

V. SUMMARY AND CONCLUSION

This paper extends the literature analyzing the cross-border transmission of financial crisis using the FSI. From a policy viewpoint, FSI offers an important tool which can help measure a degree of financial stress and identify the sources of the stress. This paper utilizes FSI to understand global, regional, and domestic factors influencing the financial stress condition of emerging market economies. The analysis also includes FSIs in various economic and geographic groupings of the countries to understand the transmission of financial shock from these different groups.

Earlier studies indicated that financial shocks spread from advanced to emerging market economies. While verifying the earlier findings, this study highlights that financial stress originated from emerging economies also exerts significant influence on the financial stress condition of other emerging market economies. Specifically, the panel regression results show that financial stress originating from emerging market economies (excluding the country of particular interest) significantly increases financial stress in domestic financial systems of the (excluded) emerging economy. Whether this shock from emerging market economies is from the same region or not did not seem to matter. The SVAR impulse responses and variance decompositions reveal that the impact of a nonregional shock is as strong as that of a regional shock or stronger on domestic FSI for most emerging market economies in the sample, except the ones in emerging Asia.

Another important finding of this study is the importance of a common regional factor in affecting domestic financial stress. The panel regression results indicate that a common regional factor significantly increases domestic financial stress in emerging Asia and emerging Europe; while the same is true only for crises periods for emerging Americas. The variance decomposition in Table 6 indicate that regional emerging market financial shocks have lasting impact in emerging Asia, which corroborates the implications of the panel regression results.

The findings of this paper encourage future researchers in the field to consider the importance of financial shocks originating not only from advanced economies but also from emerging market economies. Given the increasing importance of emerging market economies

in the global economic and financial scene, it is natural to expect increasing influence of emerging market economies in international transmission of shocks.

Together with the trend in financial integration, the findings of financial contagion present a cautionary tale. While financial activity is increasingly global, regulation remains extremely national. The growing cross-border nature of banking and financial services underscores the need for a coordinated oversight of international financial institutions and markets. Without an integrated global framework, regulatory arbitrage and inadequate cross-border information and data sharing would continue to expose national and international financial systems to financial risks and instability (Moshirian 2011). The global financial crisis prompted a wave of reforms in the global financial architecture. While the institution of global regulator is realistically difficult, there have been efforts to establish a global framework that will mandate minimum consistency across jurisdictions in regulatory principles that would apply to similar markets, institutions, services, and products. What is also important is that the regulatory oversight should be more inclusive of emerging market economies given the growing importance of emerging market financial systems.

Deepening regional integration in many developing regions imply there are additional benefits in creating responsible regional institutions and regulators for monitoring of regional market conditions and maintaining financial stability at the regional level in coordination with national and global ones. The findings also suggest there may be a common regional factor in determining the domestic financial stress condition. A shock emerging from a country may affect the countries in the same region more than those of other regions, due to similar fundamentals, integrated regional trade, financial and investment network, and/or similar responses by international investors. Especially in emerging Asia, where regional integration has made substantial progress, a number of financial issues and activities require regionally coordinated responses to improve effectiveness of these actions as well as to avoid adverse consequences of unilateral national responses.

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Determinants of Financial Stress in Emerging Market Economies
This study investigates international transmission of financial stress using the financial stress index (FSI). The results highlight the significance of regional and non-regional emerging market financial stress in increasing domestic emerging market FSI. The impulse response results also show that a regional financial shock appears to have greater impact on domestic FSI than non-regional financial shock for emerging Asia, although domestic financial stress responds the most to a domestic financial shock across the board.

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